System 300

Electrical Measurement and Stimulus (EMS 310) Module

722952–1 (XB)

LORAL

Instrumentation

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Preface

About This Manual

This manual is a complete guide to the System 300 Electrical Measurement and Stimulus (EMS 310) Module. The System 300 EMS 310 Module generates electrical test conditions and measures response waveforms for all requirements of the triservice *Remote Terminal Validation Test Plan* (RT VTP), which is the MIL–HDBK–1553 specification for remote terminal (RT) validation. The System 300 EMS 310 Module provides all of the electrical stimulus and measurement capabilities necessary to validate the design and integration of MIL–STD–1553B RTs according to the RT VTP. The module replaces a bench full of meters, oscilloscopes, and counters. Its fully automatic operation eliminates the burden of visual dial reading and manual test–probe setup.

This manual contains seven sections, six of which deal with the following information:

- Features and specifications of the System 300 EMS 310 Module
- How to set up the System 300/SBA for use with the EMS 310 Module, and how to remove the three–module EMS 310 Module Set from the System 300/SBA and install it back into the System 300/SBA
- How to perform input impedance and noise test calibration using the EMS 310 Module
- How to manually execute electrical and noise tests using the EMS 310 Module, and how to use the module in the "measurement–only" mode (measurement features only, no stimulus features)
- How to use the System 300/SBA commands associated with the EMS 310 Module
- How to interpret the System 300/SBA error and status messages associated with the EMS 310 Module

The seventh section contains a handy Command Set Card with a list and brief descriptions of the System 300/SBA commands associated with the EMS 310 Module.

Other System 300 Manuals

The *General Operating Instructions* manual is the main user document describing your System 300/SBA. The specific functions of your System 300/SBA hardware modules are contained in the various Module Manuals, such as this one. The applicable Module Manuals and the *Application Guide* are required in addition to the *General Operating Instructions*, and all of these documents should have been shipped with your System 300/SBA base system. If you have purchased an additional optional hardware module, a Module Manual should have been provided with the module.

If Problems Occur

If you encounter any problems with your System 300 EMS 310 Module, call or write:

Loral Instrumentation
Customer Service Department
8401 Aero Drive
San Diego, CA 92123
Telephone 1–800–854–1036 (toll free)

Each hardware module is identified with a serial number. This number appears on the printed circuit card itself. Any communication with Loral Instrumentation should include this number. The *System 300 General Operating Instructions* will give you additional information on what to do if you should encounter a problem with your EMS 310 Module.

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Section 1

Introduction and Specifications

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Introduction to the EMS 310 Module

Purpose of the Module

The System 300 Electrical Measurement and Stimulus (EMS 310) Module generates electrical test conditions and measures response waveforms for all requirements of the triservice *Remote Terminal Validation Test Plan* (RT VTP), the MIL–HDBK–1553 specification for remote terminal (RT) validation. The EMS 310 Module provides all of the electrical stimulus and measurement capabilities necessary to validate the design and integration of MIL–STD–1553B RTs according to the RT VTP. The module replaces a bench full of meters, oscilloscopes, and counters. Its fully automatic operation eliminates most causes of human error, including visual dial reading and manual test–probe setup.

Minimum System Configuration

Installation of the EMS 310 Module requires a base System 300 of software revision 3.0 or higher. A Simulator Module must also be installed for the same bus as that for which the EMS 310 Module and the Monitor Module are installed. This configuration uses nine of the eleven available card slots in the System 300 chassis. The EMS 310 Module is designed to be used for measurements on Bus 1, though a Monitor Module for a second bus may also be installed.

The minimum hardware configuration required to use the System 300 EMS 310 Module is a Loral Instrumentation System 300/SBA with the following five hardware modules installed (module abbreviations are in parentheses):

- Operating System Controller Module (OPS)
- OPS Memory Board (OMB)
- Monitor Module (MON)
- Simulator Module (SIM)
- EMS 310 Module (EMS310)

To find out your System 300/SBA hardware configuration, see Section 2, under "How to Determine Your System Configuration."

Capabilities of the Module

The EMS 310 Module performs the following functions:

- Generates all necessary electrical stimuli
- Captures and analyzes every bit of each test message
- Reports and displays exact measurements of critical timing and waveshape points
- Coordinates all measurements with the test scenario automatically
- Allows manual selection of individual tests and supports them fully with screen displays

The EMS 310 Module is a fully automatic instrument on a card that captures a high–speed snapshot of both stimulus and response. It integrates the essential functions of six expensive lab instruments into a single module. The module combines the stimulus and measurement capabilities needed to run the RT VTP and synchronizes them with the protocol stimulus circuitry.

The EMS 310 Module allows you to do the following:

- Conduct all your 1553 testing with one instrument
- Manually investigate surrounding conditions if an automatic test finds a problem
- Avoid a costly collection of bench instruments and the difficulty of connecting and operating them accurately
- Synchronize complex series of events without having to write your own software
- Troubleshoot with ease

The stimulation section of the EMS 310 Module has the following pertinent capabilities:

- Zero–crossing deviation (in 1–nanosecond increments)
- Amplitude variations for transformer and direct coupling
- Rise and fall time variation (for 100–nanosecond, 200–nanosecond, and 300–nanosecond trapezoidal waveforms)
- Command and data words for a bus controller
- Common mode DC (see Figure 1–1) *(Note: Common mode is the nondifferential voltage common to both conductors, specifically referring to the MIL–STD–1553 bus)*
- Common mode AC, fixed or swept
- Impedance testing
- Internal noise generator (automatic, calibrated white–noise source for internal or external noise testing)

Figure 1–1 shows examples of common mode voltage injections, both DC and AC, and Figure 1–2 shows examples of rise and fall time variation in a trapezoidal waveform.

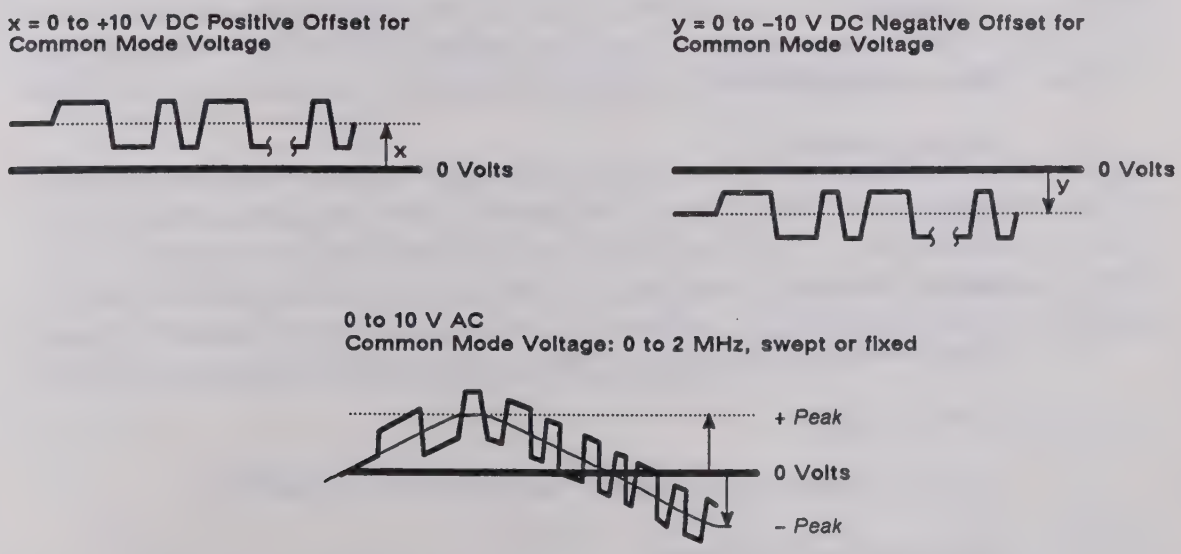
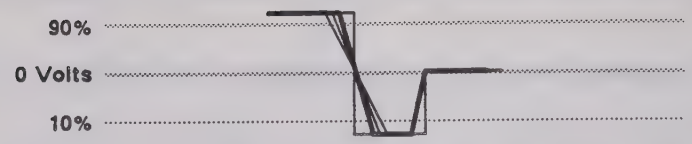

x = 0 to +10 V DC Positive Offset for Common Mode Voltage
x
0 Volts
y = 0 to –10 V DC Negative Offset for Common Mode Voltage
y
0 Volts
0 to 10 V AC
Common Mode Voltage: 0 to 2 MHz, swept or fixed
+ Peak
0 Volts
– Peak

Figure 1–1. EMS 310 Module Common Mode Voltage Injections



Trapezoidal Distortion: Programmable rise and fall time for 100, 200, and 300 nsec waveforms

Figure 1–2. EMS 310 Module Rise and Fall Time Stimulus

The EMS 310 Module measures the following electrical characteristics of a waveform:

- Terminal response time
- Ringing amplitude
- Sync rise/fall time
- Data rise time
- Data fall time
- Amplitude (peak–to–peak)
- Overshoot
- Undershoot
- Zero–crossing stability
- Output symmetry
- Output noise
- Output isolation
- Power–on noise
- Power–off noise
- Frequency stability (three levels: variables Ss1, Ss2, and S1)
- First–half sync dimensions
- Last–half parity dimensions

Figure 1–3 illustrates how some of these measurements are taken according to the measurement criteria of the RT VTP.

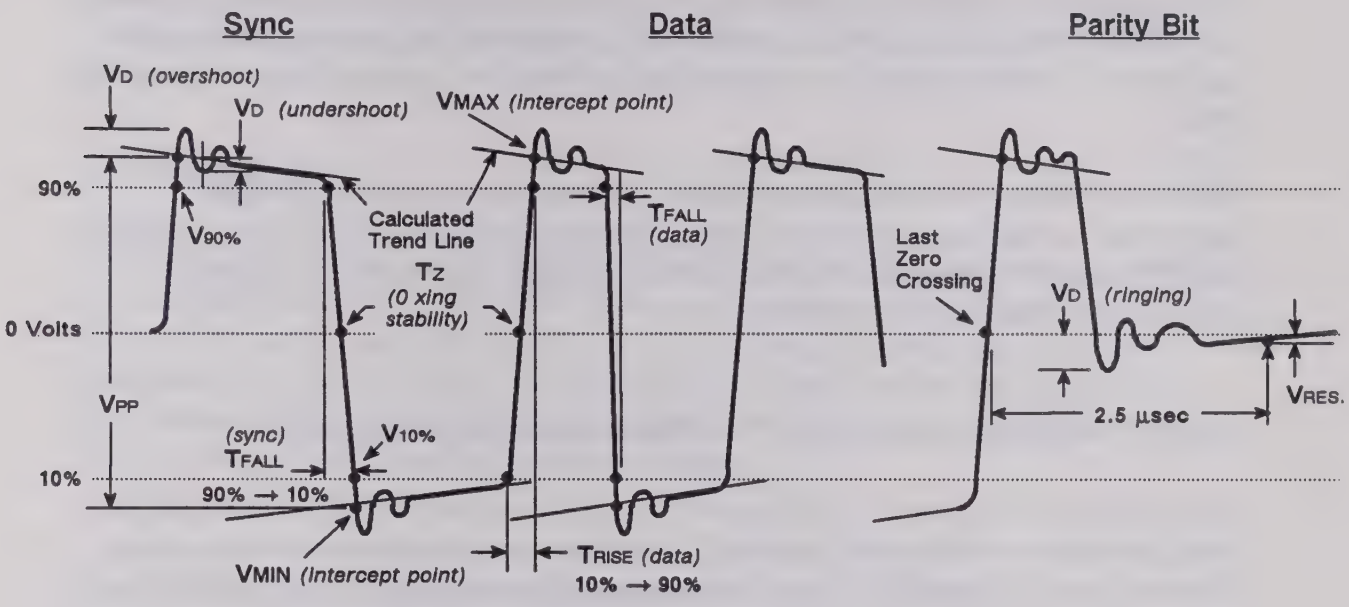


Figure 1–3. EMS 310 Module Measurement Criteria

All measurements performed by the module are automatically compared to pass criteria you select and are flagged "P" for Pass or "F" for Fail on the Electrical Measurements Page to save you time (see Figure 1–6 later in this section). The default pass criteria are those specified in the RT VTP. Before each test, all measurement calibrations are self–checked against factory settings traceable to the National Bureau of Standards.

Frequency stability is measured in a manner differently from that specified by the RT VTP. The three frequency stability variables—Ss1, Ss2, and S1—are measured by analyzing the response from the UUT (unit under test) or RT. The second half of the sync pattern (command/status sync pattern) is analyzed 10 times via transmission of the message 10 times. From this analysis are derived the minimum, maximum, and average values that are used in the formulas specified by the RT VTP.

Characteristics of the Module

With the EMS 310 Module, all functions are performed internally. The EMS 310 Module Assembly, containing the EMS 310 Module and a special cable, provides the needed equipment to perform all of the measurement and stimulus functions required by the RT VTP.

The EMS 310 Module is designed to replace six instruments: a digital storage oscilloscope, a time interval counter, a sweep function generator, a true RMS voltmeter, an LCR meter (for impedance testing), and a noise generator (for noise testing). Descriptions of these features follow.

Analog–to–Digital Converter – Digital Storage Scope Capability

The purpose of this section of the module is to capture the RT's 1 MBPS bus signal and store it in memory for detailed analysis. The circuit stores the signal voltage in precise, 10–nanosecond increments of time. The high–speed memory is capable of storing several sequential words at a time. This allows you to inspect complex responses on the bus with great flexibility. Voltage accuracy is at 1 percent of the full–scale input to at least 20 MHz. High speed provides accurate reproduction of the fast rise and fall times.

Time Interval Counter and Sweep Function Generator

This circuit can construct a wide variety of signals. The primary purpose in this application is to generate valid commands with precisely controlled distortions and data patterns to verify an RT's abilities to handle poor–quality or marginal input signals.

The synthesizer sequentially constructs a command signal one–half bit at a time as directed by the sequencer and host processor. Signal perturbations included in the sequencing process include amplitude, phase, frequency, and waveshape. Special or custom command words can be set up in the sequencer, in addition to the signal perturbations, allowing for an extremely versatile simulator.

True RMS Voltmeter

This circuit provides the capability of accurately measuring wide–band, steady–state voltages on the data bus. This circuit, coupled with a very high–speed preamp, provides the required bandwidth and sensitivity to perform all of the required tests.

LCR Meter (for Impedance Testing)

This circuit provides the capability to perform impedance measurement at input frequencies of from 75 kHz to 1 MHz at a signal level of 1.0 V RMS.

Noise Generator

This circuit provides an internal, automatic, calibrated white–noise source at a bandwidth of from less than 1 kHz to 4 MHz for noise rejection testing. The output is leveled and controlled from 140 mV RMS to 200 mV RMS. The signal and noise outputs are calibrated automatically before the noise tests are begun, and the circuit provides a power–switching relay signal for power–on and power–off tests. Any signal–to–noise ratio can be set within the ranges mentioned here.

A simplified block diagram of the EMS 310 Module is shown in Figure 1–4.

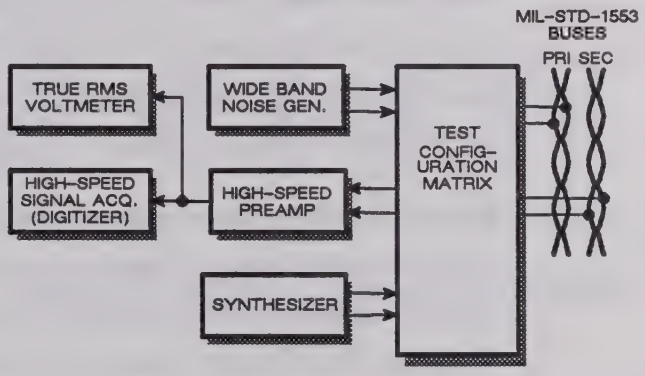


Figure 1–4. EMS 310 Module Block Diagram

The EMS 310 Module also comes with an 80–kilobyte snapshot buffer that lets you gather up to 40 consecutive words of 1553 bus traffic. This information contains the captured 1553 waveform that is used by the EMS 310 Module to calculate the measurements for the test.

CAUTION

Use of the "Error Filter (Y, N)" and "Error Filter Data" fields of the System 300's Operation Mode Setup Page (accessed using the DISPLAY OPERATION MODE command) is restricted. These fields are to be used only in conjunction with the System 300 RT Validation Test Plan (VTP) Application Software (the "VTP Software"), Model VTP310, Version 1.3 or higher, during execution of the triservice RT Validation Test Plan. (The VTP Software is operated via an IBM PC AT–compatible microcomputer or a GRiD laptop microcomputer.) At all other times, the "Error Filter (Y, N)" field should be set to its default value of "NO," which disables the command word, status word, or data word in the "Error Filter Data" field.

System 300 users who use these two fields in the enabled mode for any purpose other than with the VTP Software during execution of the RT Validation Test Plan run the risk of generating unpredictable results. For more information on these two fields, consult the *System 300 User's Manual*, *Operating System Controller Module Manual* section, Section 3, "Operation," under the description of the DISPLAY OPERATION MODE command. For more information on the VTP Software, consult the *System 300 RT Validation Test Plan (VTP) Application Software User's Manual*.

The EMS 310 Module automatically configures, performs, and then logs the results of your tests with a minimum of interaction necessary on your part. The three main display pages provided with the module are the Electrical Stimulus Page, the Electrical Measurements Page, and the Electrical Noise Test Page, samples of which are shown in Figures 1–5, 1–6, and 1–7, respectively. The Electrical Stimulus Page allows you to define the signal to be sent out on the bus. The Electrical Measurements Page displays the results of the measurements taken on the captured message; it also lets you specify the portion of the captured message you wish to have the measurements taken on. The Electrical Noise Test Page displays the results of the noise rejection test.

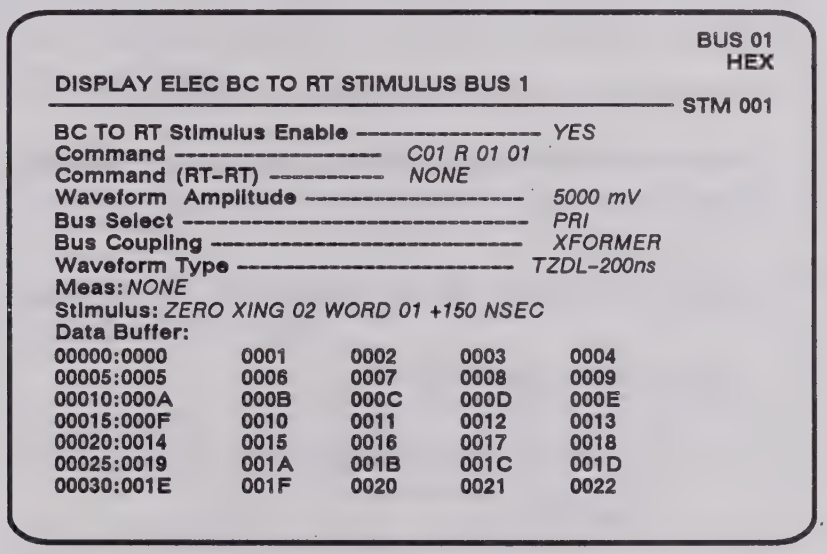

BUS 01
HEX
DISPLAY ELEC BC TO RT STIMULUS BUS 1
STM 001
BC TO RT Stimulus Enable ---------- YES
Command ---------- C01 R 01 01
Command (RT-RT) ---------- NONE
Waveform Amplitude ---------- 5000 mV
Bus Select ---------- PRI
Bus Coupling ---------- XFORMER
Waveform Type ---------- TZDL-200ns
Meas: NONE
Stimulus: ZERO XING 02 WORD 01 +150 NSEC
Data Buffer:
00000:0000 0001 0002 0003 0004
00005:0005 0006 0007 0008 0009
00010:000A 000B 000C 000D 000E
00015:000F 0010 0011 0012 0013
00020:0014 0015 0016 0017 0018
00025:0019 001A 001B 001C 001D
00030:001E 001F 0020 0021 0022

Figure 1–5. Sample Electrical Stimulus Page

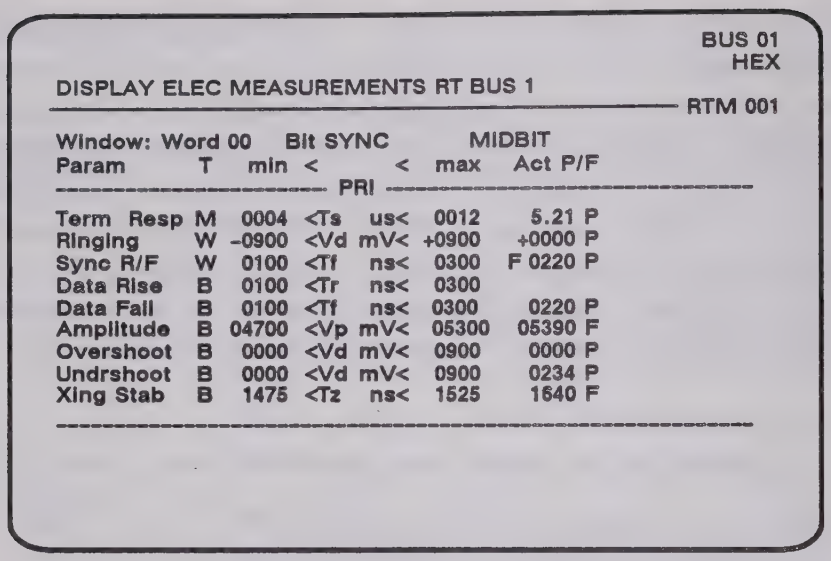

BUS 01
HEX
DISPLAY ELEC MEASUREMENTS RT BUS 1
RTM 001
Window: Word 00 Bit SYNC MIDBIT
Param T min < < max Act P/F
PRI
Term Resp M 0004 <Ts us< 0012 5.21 P
Ringing W -0900 <Vd mV< +0900 +0000 P
Sync R/F W 0100 <Tf ns< 0300 F 0220 P
Data Rise B 0100 <Tr ns< 0300
Data Fall B 0100 <Tf ns< 0300 0220 P
Amplitude B 04700 <Vp mV< 05300 05390 F
Overshoot B 0000 <Vd mV< 0900 0000 P
Undrshoot B 0000 <Vd mV< 0900 0234 P
Xing Stab B 1475 <Tz ns< 1525 1640 F

Figure 1–6. Sample Electrical Measurements Page

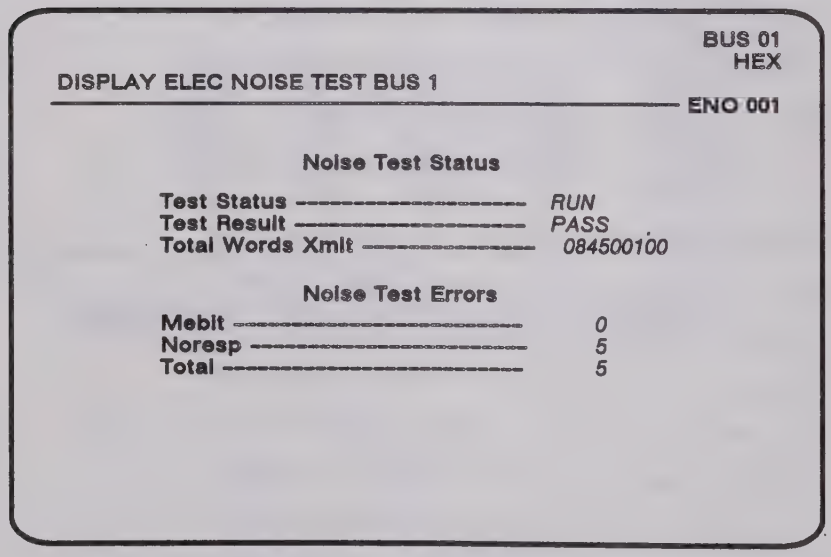


Figure 1–7. Sample Electrical Noise Test Page

You can specify the following variables on the Electrical Measurements Page for analysis of the waveform at a particular location:

- Word number
- Bit number
- Bit position (leading, midbit, or trailing edge)

When you run the electrical measurements and capture the information at a specific point on the waveform, if you want to analyze the waveform at a different location you must first change the three variables listed above to the desired point and then redisplay the Electrical Measurements Page.

When running the stimulus section of the EMS 310 Module, note that proper protocol is to disable any active BC (internal or external) and halt transmission from the System 300.

One way to use the EMS 310 Module for your testing and validation functions is to follow the following five–step process:

1. Set up the Electrical Stimulus Page for a particular test. Access this page via the **DISPLAY ELECTRICAL BC TO RT STIMULUS** command.

2. Set up the Electrical Measurements Page for the test. Access this page via the **DISPLAY ELECTRICAL MEASUREMENTS** command. (If you're performing the noise test, you can skip this step.)

3. Run the test using the **RUN ELECTRICAL MEASUREMENT** command. If you're performing the noise test, run the test using the **RUN NOISE TEST** command.

4. Display the results of the test on the Electrical Measurements Page. Again use the **DISPLAY ELECTRICAL MEASUREMENTS** command for this. If you're performing the noise test, display the results of the test on the Electrical Noise Test Page using the **DISPLAY ELECTRICAL NOISE TEST** command.

5. Log and interpret the results of the test from the displayed waveform information or the displayed noise test information.

EMS 310 Module Specifications

Table 1–1 lists the specifications of the EMS 310 Module.

Table 1–1. Specifications

General	
Power Consumption	30 watts @ 6 amps/5 volts DC
Chassis	Three slots
Position	Adjacent to associated Monitor Module
Digitized Memory	80K x 8 SRAM
Writeable Control Memory	2K x 16 SRAM
Writeable Waveform Memory	8K x 8 SRAM
Waveform Synthesizer	DRFS3250–20
Dimensions (double Eurocard size)	
Height	6.530 in. (165.86 mm)
Width	9.187 in. (233.34 mm)
Depth	2.40 in. (60.96 mm)
Inputs/Outputs	
All module data conforms to VMEbus electrical specifications.	
External MIL–STD–1553B interfaces to data bus and Monitor Module (direct or transformer); Trompeter PL75C triaxial connector will mate.	

continued...

Table 1–1. Specifications (continued)

Program Setup
Keyboard: Prompted by page displays (requires Display and Keyboard Controller [DKC] Module or VT100–type terminal).
The System 300 can be remotely controlled through a host computer via standard IEEE–488 or RS–232C. Loral Instrumentation provides two software packages to automate RT testing: *System 300 RT Production Test Plan (PTP) Software* and *System 300 RT Validation Test Plan (VTP) Software*. You can also generate your own programs to control the System 300.
Functions
Performs all electrical test stimuli of the RT Validation Test Plan.
Eliminates the need for complicated interconnection of lab equipment. To the extent required by the RT Validation Test Plan, the EMS 310 Module replaces a Storage Oscilloscope, a Time Interval Counter, a Sweep Function Generator, a True RMS Voltmeter, an Impedance Bridge, and a White Gaussian Noise Source.
Provides tables reporting exact values of measurements automatically.
Stores snapshot of bus traffic and will analyze any bit of the message.
Takes electrical measurements on waveform Leading, Trailing, or Mid–bit transitions.
Can be set to accept and generate either Sinusoidal (1 MHz) or Trapezoidal (@ 100, 200, or 300 nsec rise/fall time) waveforms.
Monitor Module connects to the data bus via the EMS 310 Module.
True RMS voltmeter has analog bandwidth > 10 MHz with 1% accuracy for input impedance, output noise, and noise rejection tests. Input range 1.5 mV to 15 V RMS in four scales. Settling within 400 msec. Overvoltage protected.

continued...

Table 1–1. Specifications (continued)

Error Detection

Optional Display and Keyboard Controller (DKC) Module monitor or VT100–type terminal monitor displays "P" for pass if the UUT (unit under test) signal is within the specified pass criteria; otherwise, "F" for fail appears. The pass criteria are defaulted to those of the RT Validation Test Plan upon powerup, but you can change these criteria as desired. Measurement can be taken at any bit transition in the test message (Leading, Trailing, or Mid–bit). The RT Validation Test Plan pass criteria are shown below.

Bus Measurement	Pass Criteria
Terminal Response Time	4–12 µsec (10 nsec resolution)
Ringing	< ±900 mV, peak, line–line (transformer coupled); < ±300 mV (direct coupled)
Rise/Fall Times for Data Bits and Sync (10–90%)	100–300 nsec
Amplitude, Output (1% resolution)	0.0–30.0 V, peak–peak, line–line
Overshoot/Undershoot	< ±900 mV, peak, line–line (transformer coupled); < ±300 mV (direct coupled)
Zero–Crossing Stability	< ±25 nsec from 500 nsec interval (475–525 nsec) (10 nsec resolution)
Output Symmetry (@ 2.5 µsec after mid–parity bit, 10 nsec resolution)	±250 mV (transformer coupled); ±90 mV (direct coupled)
Output Noise	0–14.0 mV RMS (transformer coupled); 0–5.0 mV RMS (direct coupled)
Output Isolation	45 dB minimum
Frequency Stability	1 MHz, ±0.01% (long term) (done by analysis on bus)
Bit Time	1000 nsec ±0.01% (long term) (10 nsec resolution)
Input Impedance	1000 Ω, min. (transformer coupled); 2000 Ω, min. (direct coupled)

continued...

Table 1–1. Specifications (continued)

Bus Stimulus
The following test conditions can be generated: • Sinusoidal (1 MHz) or Trapezoidal (100 nsec, 200 nsec, or 300 nsec) Waveform • Waveform Amplitude: 35 mV to 9 V, peak–peak, line–line • Common Mode: 0–10 V AC (sweeps from 0 to 2 MHz, or set any fixed frequency within that range) or 0 to ±10 V DC • Zero–Crossing Deviation: Any word, any bit time, 0 to ±200 nsec (1 nsec resolution) • Input Impedance: 75 kHz–1 MHz, 1 V RMS • Gaussian Noise Generation: 4 MHz; Level: 140–200 mV RMS

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Inserting and Setting Up the EMS 310 Module

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Power Requirements

30 watts @ 6 amps/5 volts DC

Minimum System Configuration Required

Installation of the EMS 310 Module requires a base System 300 of software revision 3.0 or higher. A Simulator Module must also be installed for the same bus as that for which the EMS 310 Module and the Monitor Module are installed. This configuration uses nine of the eleven available card slots in the System 300 chassis. The EMS 310 Module is designed to be used for measurements on Bus 1, though a Monitor Module for a second bus may also be installed.

Minimum Hardware Configuration

The minimum hardware configuration required to use the System 300 EMS 310 Module is a Loral Instrumentation System 300/SBA with the following five hardware modules installed (module abbreviations are in parentheses):

- Operating System Controller Module (OPS)
- OPS Memory Board (OMB)
- Monitor Module (MON)
- Simulator Module (SIM)
- EMS 310 Module (EMS310)

To find out your System 300/SBA hardware configuration, see the next subsection.

How to Determine Your System Configuration

To find out your System 300/SBA hardware configuration (and software and microcode configuration), do the following—provided you have either a Display and Keyboard Controller (DKC) Module keyboard and monitor or a VT100–type terminal:

1. Turn on the System 300. (Press the button marked "PWR" on the front panel of the machine.)

2. When the System 300 has finished its initialization process and the command–line prompt is displayed, type the command **DISPLAY CONFIGURATION**, followed by a (RETURN). The System 300 Configuration Page will come up on your screen. A sample of this page is shown in Figure 2–1, showing the minimum configuration necessary for using the EMS 310 Module.

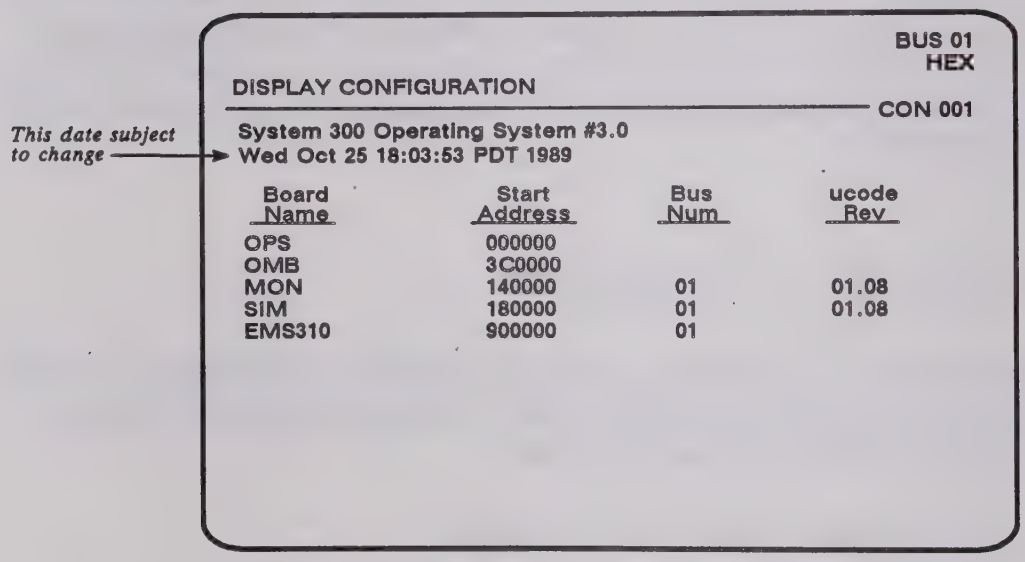


Figure 2–1. Sample Configuration Page, Showing Minimum System Configuration Necessary for Using EMS 310 Module

Read your system configuration from the Configuration Page. The hardware modules contained in your system are listed under the "Board Name" column. The starting memory address assigned to each module is listed in the "Start Address" column. The bus number assigned to each module is listed in the "Bus Num" column. The version number of the microcode associated with each module is listed in the "ucode Rev" column (for "Microcode Revision").

Table 2–1 shows all the module abbreviations that may appear in the "Board Name" column and what they stand for.

Table 2–1. Board Name Abbreviations on the Configuration Page and Their Meanings

Board Name Abbreviation	Full Board Name
OPS	Operating System Controller Module
OMB	OPS Memory Board
MON	Monitor Module
SIM	Simulator Module
DKC	Display and Keyboard Controller Module
EMS310	Electrical Measurement and Stimulus 310 Module

Switch Settings

The switch settings of your EMS 310 Module were preset at the factory to your System 300 configuration. If you ever need to verify these module switch settings, Table 2–2 shows their proper positions. (The switches are located on the Synthesizer card of the EMS 310 Module Set.) Switches 10 to 5 determine the six most significant system address bits for mapping the EMS 310 Module into your system. Switches 4 to 1 determine the module's bus number.

Table 2–2. Standard Factory Switch Settings for the System 300 EMS 310 Module (Located on Synthesizer Card)

SWITCH SEGMENT	1	2	3	4	5	6	7	8	9	10
SW1	O	C	C	C	C	C	O	C	C	O

O = Open = 5V (Logic 1)
C = Closed = Ground (Logic 0)

Note that improper switch settings on *any* System 300 module will cause your System 300 to be inoperative and may result in damage. The overall System 300 Module Switch–Setting Matrix, which contains the proper switch settings for every module in every configuration of the system, can be found in the *System 300 Application Guide*. Use this Module Switch–Setting Matrix to verify the module switch settings for your particular configuration.

How to Remove and Install the EMS Module Set

The EMS 310 Module Set, consisting of three modules, was installed at the factory, and normally does not require that you remove it or install it. However, if for any reason you wish to remove the Module Set and re–install it, such as for the Advance Turnaround program, follow the instructions in the next two subsections.

> **NOTE** Before removing or installing the EMS Module Set, please contact Loral Instrumentation Customer Service at 1–800–854–1036 (toll free).

How to Remove the EMS Module Set

> **NOTE** We recommend the use of Electrostatic Discharge (ESD) protection techniques while handling exposed circuit boards.

1. Make sure that the System 300 is turned off and that the power cord is unplugged from the power source.

2. Disconnect all cables from the rear-panel connectors on the EMS Module Set. There are five connectors on the high-speed amplifier module (labeled "INP PRI," "INP SEC," "1553 PRI," "1553 SEC," and "PWR KEY") and one on the digitizer module (labeled "NOISE GATE"). Figure 2–2 shows a typical connection diagram for these connectors.

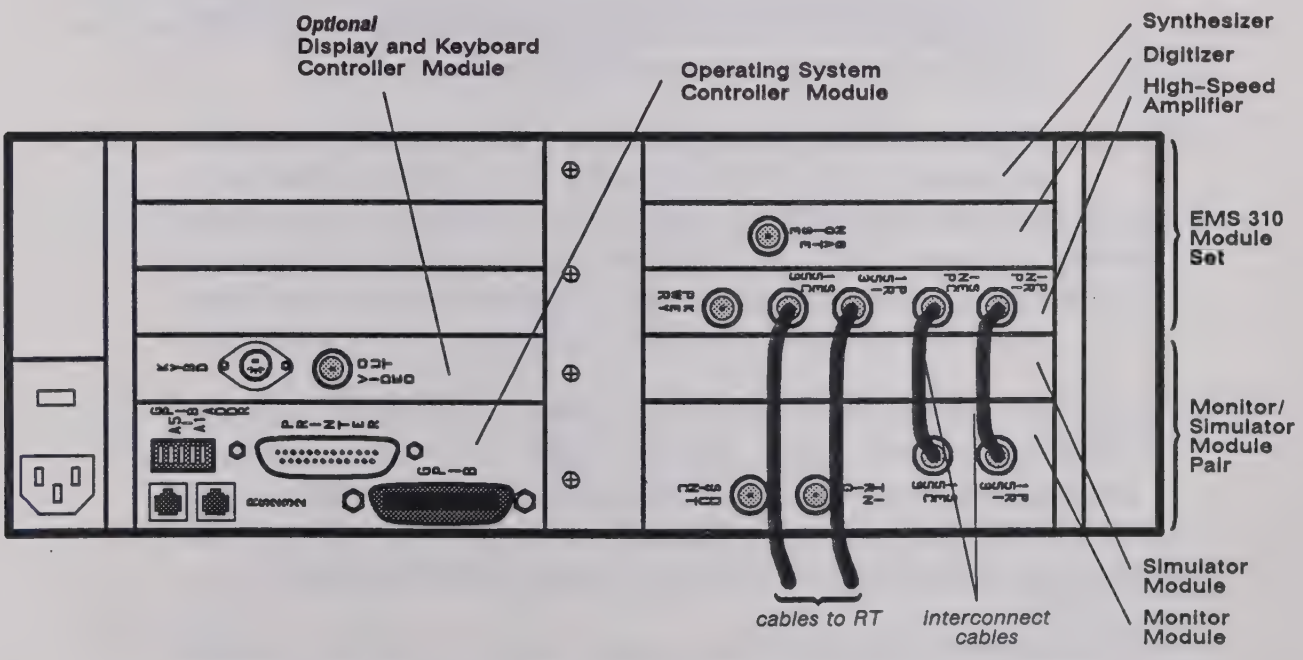


Figure 2–2. Typical System 300 Rear Panel Showing EMS 310 Module Set and Connectors

3. Remove the top cover of the System 300. Using a Phillips screwdriver, remove the six flat–head screws securing the top cover to the chassis. Note that the screws are of two different sizes: two are of a larger size, 8–32 x 3/8, and four are of a smaller size, 6–32 x 3/8. The two larger screws are secured in the front sides of the unit. The four smaller screws are secured as follows: two are in the top of the unit (one at front center and one at rear center), and two are in the rear sides of the unit.

> **NOTE** Make sure that when you replace the top cover you insert the proper–sized screws in the proper holes.

Once you have removed the six top–cover screws, simply lift the top cover off of the chassis.

4. Raise the swing–up card cage. Lift the back of the card cage up to swing it into a vertical position (see Figure 2–3). The card cage will lock at a 90–degree point by way of a spring–loaded pin located on the hinge. The EMS Module Set is now accessible for removal.

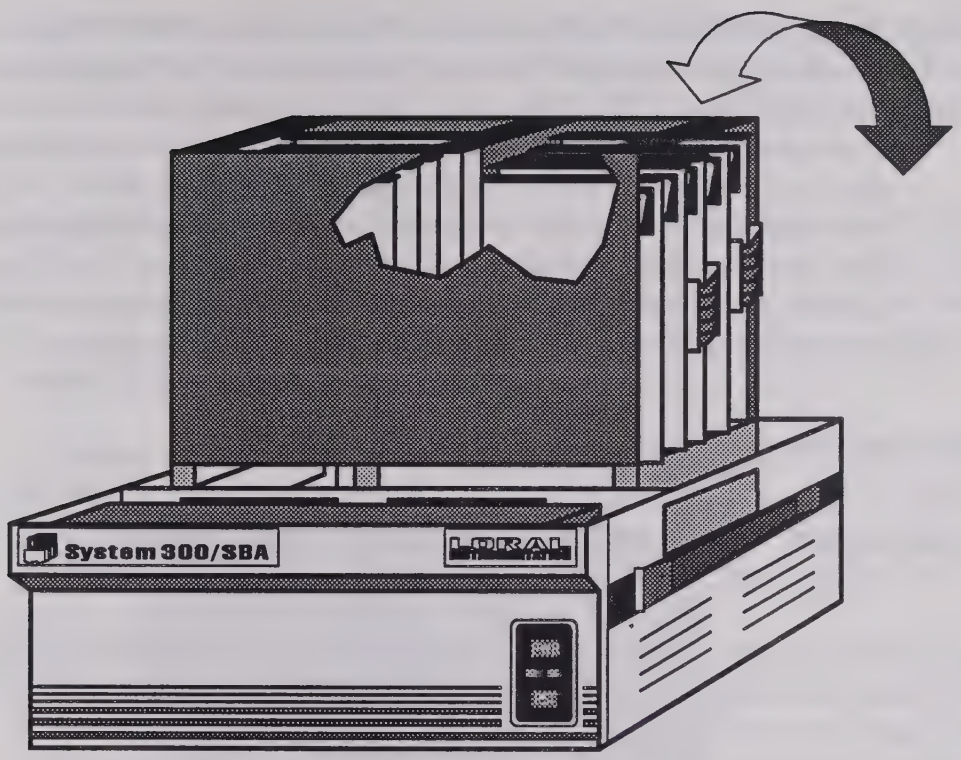


Figure 2–3. Cabinet Shown with Card Cage Raised for Access

5. Disconnect, at the digitizer module end, the thin coaxial cable going from the high–speed amplifier module to the digitizer module. Unscrew the hex–shaped coaxial/SMA connector from the post attached near the bottom of the digitizer module, just above the flat ribbon cable connector. Leave the coaxial cable attached to the high–speed amplifier module. This will keep it from getting lost when the EMS Module Set is removed.

6. Disconnect, at the digitizer module end, the flat ribbon cable going from the synthesizer module to the digitizer module. Pull the "ears" (also known as clips or ejectors) of the connector away from each other to disengage the cable from the connector. Leave the cable attached at the synthesizer module end. This will keep it from getting lost when the EMS Module Set is removed.

7. Disconnect, at the high–speed amplifier module end, the flat ribbon cable going from the synthesizer module to the high–speed amplifier module. Again pull the ears of the connector away from each other to disengage the cable from the connector. Leave this cable attached to the synthesizer module also.

8. Using a Phillips screwdriver, remove the top and bottom 4–40 pan–head screws that attach each of the three modules in the EMS Module Set to the card–cage frame. The top screw of each module attaches the module's rear–panel connector plate to the card–cage frame (at the connector–plate tab), and the bottom screw attaches the module's clevis block (bracket) to the card–cage frame. Figure 2–4 shows a sample module as it appears in side view when the card cage is in the raised position. Shown, among other things, are the rear–panel connector plate at the top, the clevis block at the bottom, and the two 4–40 pan–head screws at the top and bottom.

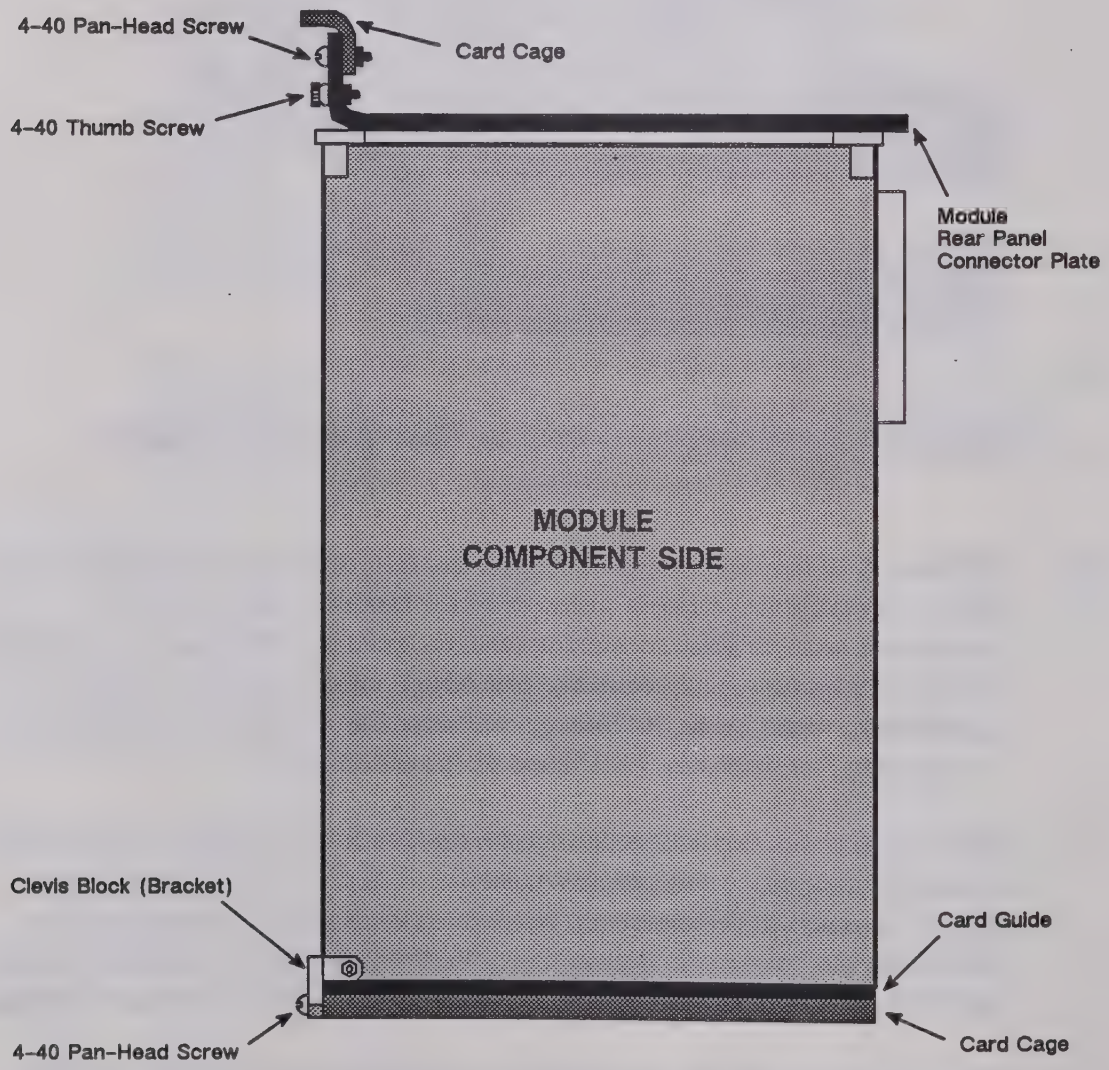


Figure 2–4. Sample Module (Shown in Side View While Card Cage Is in Raised Position)

9. Remove the three modules in the EMS Module Set, one at a time, taking careful note of their position in the card cage and their position relative to each other. (You will need to replace them, or their replacement modules, in the same position. Figure 2–2 shows a typical installation.)

   To remove the modules, note first that, as shown in Figure 2–4, with the card cage in the raised position each module has a thumb screw attached to the rear–panel connector–plate tab at the top of the module and a clevis block (bracket) attached to the bottom of the module. These will assist you in removing the module.

   To remove a module, grab the thumb screw at the top and the clevis block at the bottom and, using equal force at both ends, pull the module out of the card cage. Exert even, outward pressure until the module separates from the motherboard socket, then slide the module from the card–cage assembly.

   The module should require minimal force to extract. You may need to jiggle it up and down gently a few times if you encounter slight resistance. If you encounter excessive resistance, the module may be misaligned or may be in contact with another module. Investigate and correct any excessive resistance before you resume removing the module.

   As you remove each module, place it on a flat, non–conducting surface with the component side facing up. *Do not place the modules on the System 300.*

How to Install the EMS Module Set

NOTE	We recommend the use of Electrostatic Discharge (ESD) protection techniques while handling exposed circuit boards.

1. Make sure that the System 300 is turned off, the power cord is unplugged from the power source, the top cover is removed, and the swing–up card cage is rotated up in the 90–degree position. If not, follow steps 1, 3, and 4 under "How to Remove the EMS Module Set."

2. Install the three modules in the EMS Module Set in the card cage, one at a time. Be sure that the modules are in the same position in the card cage, and relative to each other, that they were in when you removed them. (See Figure 2–2 earlier for a typical configuration.)

   To install the modules, note again that each module has a rear–panel connector–plate tab on one corner and a clevis block (bracket) on another corner (see Figure 2–4 earlier). These will assist you in inserting the module into the card cage. (When not installed in the system, the modules should be stored on a flat surface with the component side facing up. *Never place the modules on the System 300!*)

   To install a module, hold the module by the rear–panel connector–plate tab at one end and the clevis block at the other end and place the module into the card cage. With the card cage in the raised position, this means that the connector–plate tab will be at the top and the clevis block will be at the bottom, both facing out from the card cage, as shown in Figure 2–4 earlier. Make sure that the bottom edge of the module (the edge containing the clevis block) is inserted into the card guide in the proper slot for that module.

   Using equal pressure at top and bottom of the module, simultaneously push the connector–plate tab at the top and the clevis block at the bottom and slide the module into the card–cage assembly until the mating connectors are fully engaged. The connector–plate tab must end up flat against the edge of the card–cage frame.

   The module should require minimal force to insert. You may need to jiggle it up and down gently a few times if you encounter slight resistance. If you encounter excessive resistance, the module may be misaligned or the connectors may be contacting incorrectly. Investigate and correct any excessive resistance before you resume inserting the module.

   Note that when the module is installed, the component side of the module will face in the same direction as the component side of the other modules in that side of the card cage.

3. Using a Phillips screwdriver, replace the top and bottom 4–40 pan–head screws that attach each of the three modules in the EMS Module Set to the card–cage frame. The top screw of each module attaches the module's rear–panel connector plate to the card–cage frame (at the connector–plate tab), and the bottom screw attaches the module's clevis block to the card–cage frame (see Figure 2–4 earlier).

4. Reconnect, at the high–speed amplifier module end, the flat ribbon cable going from the synthesizer module to the high–speed amplifier module. Pinch the ears (clips, ejectors) of the connector together to lock it in place.

5. Reconnect, at the digitizer module end, the flat ribbon cable going from the synthesizer module to the digitizer module. Pinch the ears of the connector together to lock it in place.

6. Reconnect, at the digitizer module end, the thin coaxial cable going from the high–speed amplifier module to the digitizer module. Simply screw the hex–shaped coaxial/SMA connector to the post attached near the bottom of the digitizer module, just above the flat ribbon cable connector.

7. Lower the swing–up card cage. Relieve pressure on the locking hinge–pin by pulling the top of the card cage toward the front of the unit. Pull out the spring–loaded hinge–pin on the right side of the unit and gently lower the card cage to the horizontal resting position. Now release the hinge–pin.

8. Replace the top cover. First align the cover so that the air–vent pattern on its sides matches the air–vent pattern on the bottom sides of the system. Then lower the top cover onto the unit, making sure that the sides of the top cover go inside the chassis rails on either side of the unit. (The chassis rails hold the carrying handles.) Push down on the top cover until it is flat against the top of the chassis. Now slide the top cover forward, towards the front of the system, until it is flat against the back of the front panel.

   Using a Phillips screwdriver, replace the six flat–head screws that secure the top cover to the chassis, making sure that the proper screws go in the proper holes. The two larger screws (8–32 x 3/8) go in the front sides of the unit. Two of the smaller screws (6–32 x 3/8) go in the top of the unit (one at front center, one at rear center), and the other two smaller screws go in the rear sides of the unit.

9. Reconnect all cables to the rear–panel connectors on the EMS Module Set. There are five connectors on the high–speed amplifier module (labeled "INP PRI," "INP SEC," "1553 PRI," "1553 SEC," and "PWR KEY") and one on the digitizer module (labeled "NOISE GATE"). Figure 2–2 shows the proper hookup for the cables going to the INPUT primary and secondary and 1553 primary and secondary connectors.

10. Plug the power cord of the System 300 back into the power source and turn the system back on. The EMS Module Set is now ready to be used with the System 300.

Test Requirements

The EMS 310 Module does not require unique test information. The system has built–in self–test capabilities. In the event of a module malfunction (isolated by diagnostic routines and device drivers), an error message or diagnostic indication, as appropriate, will be displayed on your Display and Keyboard Controller (DKC) Module monitor or your VT100–style terminal screen. Error and status messages particular to the EMS 310 Module, and their meanings, are listed in Section 6 of this manual.

The *System 300 Operating System Controller Module Manual* contains general error messages and diagnostics descriptions for the Operating System Controller Module, the Monitor Module, the Simulator Module, and the Display and Keyboard Controller Module. See Section 4 of that manual, entitled, "Error Messages and Diagnostics Descriptions."

Rear-Panel Connectors

There are six connectors on the EMS 310 Module Set that are part of the System 300 rear panel. These connectors and their functions are listed in Table 2–3 for easy reference. Five of the connectors are on the High–Speed Amplifier plate, and one is on the Digitizer plate (see Figure 2–5).

Table 2–3. External (Rear Panel) Connection Interface Specifications for the EMS 310 Module

Connector	Signal	Description
INP PRI	MIL–STD–1553	Provides the primary bus connection from the EMS 310 Module to the System 300 Monitor Module.
INP SEC	MIL–STD–1553	Provides the secondary bus connection from the EMS 310 Module to the System 300 Monitor Module.
1553 PRI	MIL–STD–1553	Provides the primary 1553 bus connection to the unit under test (UUT).
1553 SEC	MIL–STD–1553	Provides the secondary 1553 bus connection to the unit under test (UUT).
PWR KEY	*Not Applicable*	Internal switch for remote power control of an RT.
NOISE GATE	TTL	Bidirectional port used for internal and external noise gate triggering.

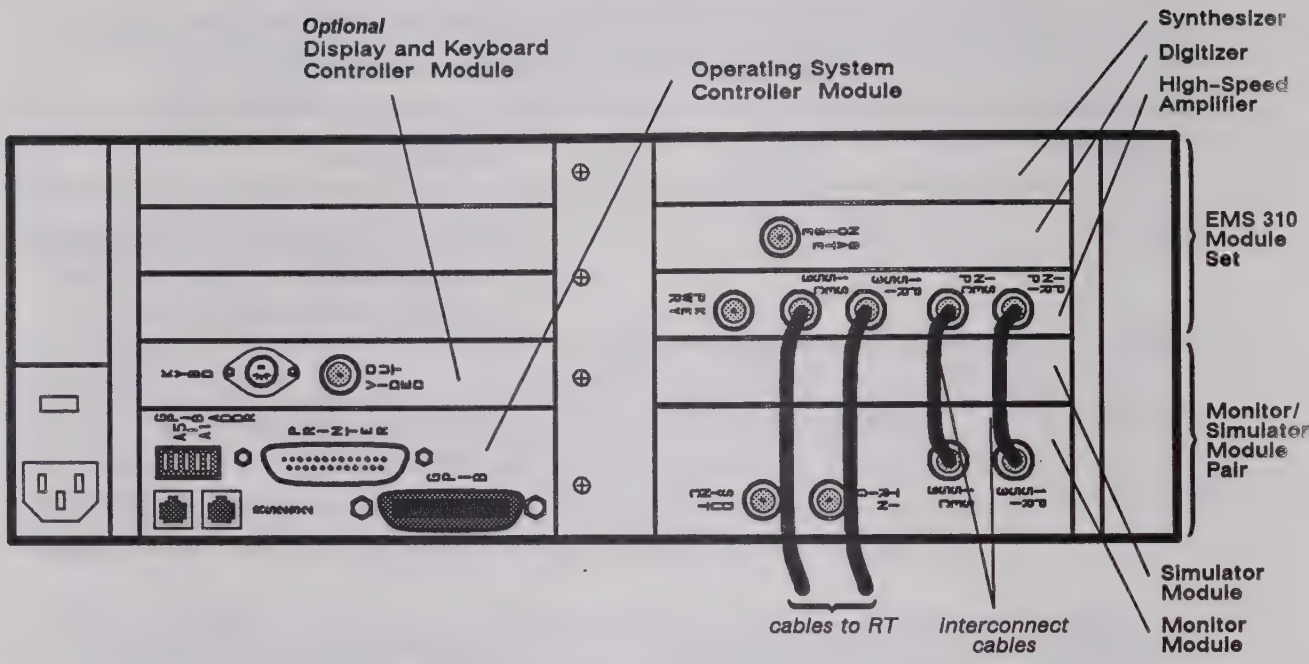
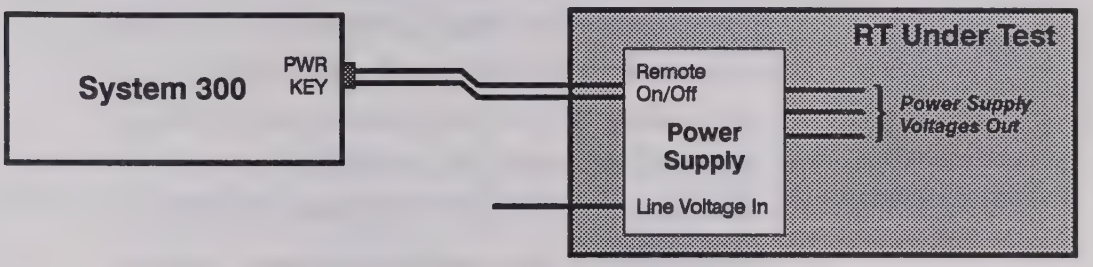


Figure 2–5. Typical System 300 Rear Panel Showing EMS 310 Module Set and Connectors

Two of the rear-panel connectors, labeled "INP PRI" and "INP SEC," interface with the primary and secondary MIL–STD–1553B Multiplex Data Bus connectors, respectively, of a System 300 Monitor Module (labeled "1553 PRI" and "1553 SEC" on the Monitor Module). These enable the EMS 310 Module to attach to a base System 300 through the rear panel of the Monitor Module. Two more connectors, labeled "1553 PRI" and "1553 SEC," interface with a MIL–STD–1553B Multiplex Data Bus (primary and secondary), providing the primary and secondary 1553 bus connectors for the System 300 when the EMS 310 Module is installed. All four of these connectors are triaxial type.

A fifth connector, labeled "PWR KEY" and of BNC type, is a remote power control key that interfaces with a remote terminal (RT). The power key allows the System 300 to control a remote power switch to the RT. This switch is a normally open connection. A schematic diagram with specifications is shown in Figure 2–6. The System 300 provides an open circuit for the power–off state and a closed circuit for the power–on state. The RT must be connected to the power key such that a closed circuit powers the RT and an open circuit turns the RT off. The power key is required to execute power on/off tests. In particular, it is controlled via the PWR ON and PWR OFF settings in both the O/P NOISE (output noise) condition in the "Measurement" field of the Electrical Stimulus Page and the ZIN (input impedance) condition in the "Stimulus" field of the Electrical

Stimulus Page. (The Electrical Stimulus Page is accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command—see Section 5, "Operation.")



Power key resistance = 0.15 Ω max
Power key contact load rating = 0.5 A continuously
Power off state: Relay switch is open
Power on state: Relay switch is closed

Figure 2–6. Power Key Wiring Diagram to External RT

A sixth connector, labeled "NOISE GATE" and also of BNC type, is a bidirectional port used for internal and external noise gate triggering. It is used during the noise test to control the generation of noise via the internal noise source. Its direction is chosen via the NOISE GATE and EXTERNAL NOISE GATE options in the "Stimulus" field of the Electrical Stimulus Page. NOISE GATE switches the connector to TTL output, active high, and EXTERNAL NOISE GATE switches the connector to TTL input, active high. Connect the external noise gate to this connector via a standard BNC cable.

The "NOISE GATE" connector is located on the Digitizer plate of the EMS 310 Module Set; the other five connectors are located on the High–Speed Amplifier plate.

How to Hook Up an RT to the System 300 for Testing

To test an RT using the System 300 with an EMS 310 Module installed, you must have the RT connected to the System 300 via either a transformer–coupled stub (cable) or a direct–coupled stub. As specified in MIL–STD–1553, transformer couplings should be used to attach longer–length stubs between the EMS 310 Module and the RT. Direct coupling can be used for short stubs. Triaxial connectors (Trompeter PL75 series) are used on the System 300, and a pair of mating cable end–connectors was provided with your system for each Monitor Module purchased.

NOTE Impedance testing requires keeping the cables that connect the System 300 to the RT under test to the minimum practical length ("cables to RT" in Figure 2–5 earlier). Also, the electrical characteristics of these cables will have an impact on the accuracy of impedance measurements taken during test *5.1.2.3 Input Impedance* of the RT Validation Test Plan. We therefore recommend specifications similar to those of the following MIL–STD–1553 cables available through Loral Instrumentation (LI). LI part number 260052–1 is 3.3 feet (1 meter) long and is recommended for direct coupling. LI part number 260052–2 is 5 feet (1.5 meters) long and is recommended for transformer coupling. Both part numbers use the following cable: Belden 9222, RG–58A/U type triaxial cable, 20 AWG (7×28 stranding), .037 inch diameter, tinned copper, 96% shield coverage, 50Ω nominal impedance, 30.8 pF/ft (101 pF/m) nominal capacitance. Cable end–connector specifications are as follows: identical 3–lug male triaxial end–connectors at both ends. Note also that the two cables used to connect the System 300 to the RT under test must be identical in all respects, particularly length.

On the System 300 side, connect the primary and secondary bus stub cables, respectively, to the two connectors labeled "1553 PRI" and "1553 SEC" on the EMS 310 Module's High–Speed Amplifier plate on the System 300 rear panel (see Figure 2–5 earlier—look especially where it says "cables to RT"). Note that if your EMS 310 Module is properly installed, the connectors labeled "1553 PRI" and "1553 SEC" on the Monitor Module should already be connected to the two "INP PRI" and "INP SEC" connectors, respectively, on the EMS 310 Module's High–Speed Amplifier plate. (In Figure 2–5, the cables connecting the Monitor Module to the High–Speed Amplifier plate are labeled

"interconnect cables." These are two 3–inch MIL–STD–1553 cables that were supplied with the system and were installed at the factory. If these cables have become disconnected during shipment, reconnect them as shown in Figure 2–5.) Even while you are performing only protocol testing when using your System 300 with the EMS 310 Module installed, you should still maintain the connections listed here so that you can easily perform electrical testing without having to switch cables.

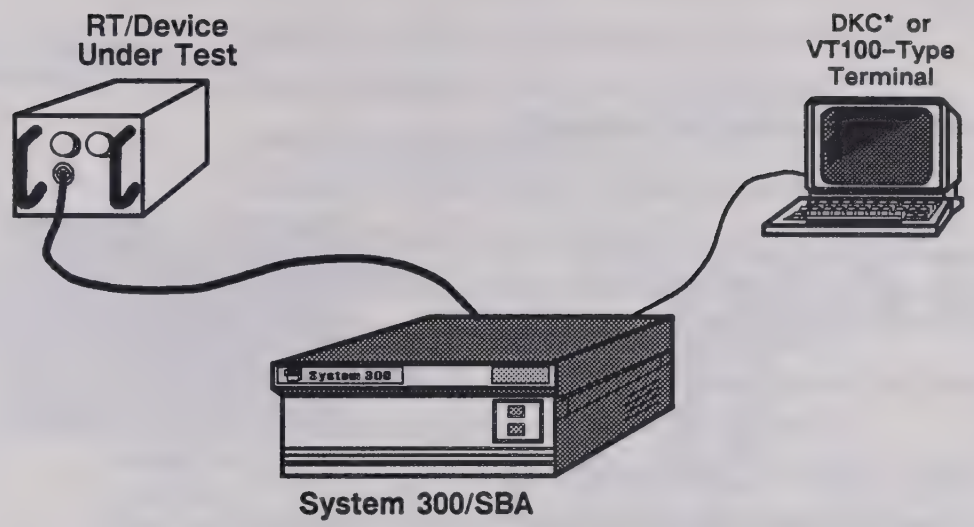
On the RT side, connect the primary and secondary bus cables to the primary and secondary bus connectors, respectively, of your RT—these will vary depending on your RT.

Once you've performed these steps, the RT is connected to the System 300, and you're ready to test the RT. Figure 2–7 shows an example of a single–redundant bus test configuration (direct coupled) using the System 300/SBA. Note that if you wish to set up a *dual–redundant* bus test configuration, you will need to set up two identical paths.

NOTE

Figure 2–7 corresponds to Figure 1A, "General Resistor Pad Configuration," of the RT Validation Test Plan (Section 100 of MIL–HDBK–1553A). For the primary bus, "Point A" of that figure corresponds to the "1553 PRI" connector on the rear panel connector plate of the High–Speed Amplifier Module portion of the EMS 310 Module Set (see Figure 2–5 earlier). For the secondary bus, "Point A" of Figure 1A corresponds to the "1553 SEC" connector on the rear panel connector plate of the High Speed Amplifier Module.

Note that Figure 1A of the RT VTP is the proper configuration to use for all tests of the RT VTP except when you are required to use a bus network for the input electrical tests (paragraph 5.1.2, "Input characteristics"). In that case Figure 1B of the RT VTP, "General Bus Configuration," is the proper configuration. Compatibility with Figure 1B is currently under development.



Display and Keyboard Controller (monitor and keyboard)

Figure 2–7. Example of a Single–Redundant Bus Test Configuration (Direct Coupled) Using the System 300/SBA

How to Hook Up the Input Impedance Calibration Fixture to the System 300 and an RT

The input impedance calibration fixture is used during the input impedance calibration procedures. For instructions on how to perform these procedures, see Section 3.

Figure 2–8 shows the proper hookup for the calibration fixture, showing a typical System 300 rear panel.

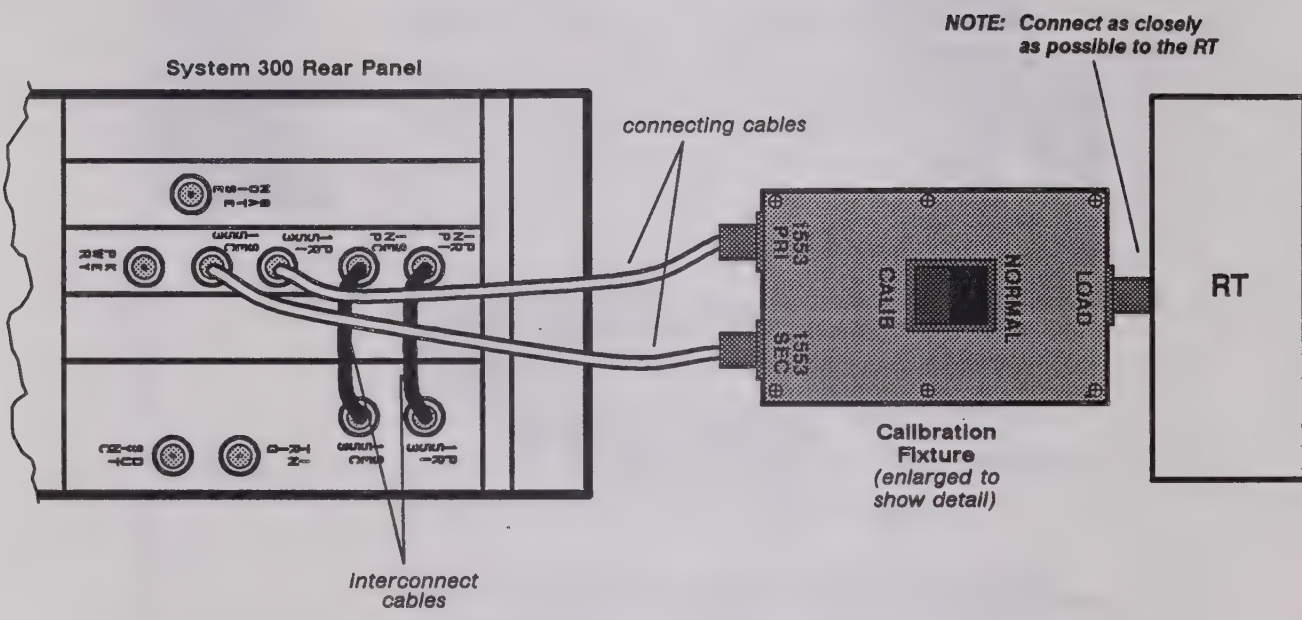


Figure 2–8. Proper Hookup of Input Impedance Calibration Fixture to System 300 and RT

Notice that the cables going from the System 300 to the calibration fixture (marked "connecting cables" in Figure 2–8) originate at the 1553 PRI (primary) and 1553 SEC (secondary) connectors on the High–Speed Amplifier plate. These cables are marked "cables to RT" in Figure 2–5 earlier. All you need do is disconnect these cables at the RT end, then reconnect them to the matching connectors on the calibration fixture (1553 PRI to 1553 PRI, 1553 SEC to 1553 SEC), and then connect the "LOAD" connection at the other end of the fixture directly to the RT. *If you cannot connect the calibration fixture directly to the RT, use the adapter supplied with the fixture. If you still cannot connect the fixture to the RT, you must build your own adapter—but keep the cabling as short as possible.* Once the calibration fixture is connected to both the System 300 and the RT, set the switch on the fixture to "CALIB," for calibrate, and you're ready to perform the input impedance calibration procedures. When you're finished performing the calibration procedures, set the switch to the "NORMAL" position. The switch must be in the "NORMAL" position when you run the input impedance test portion of the RT Validation Test Plan.

NOTE Impedance testing requires keeping the cables that connect the System 300 to the RT under test (marked "connecting cables" in Figure 2–8) to the minimum practical length. Also, the electrical characteristics of these cables will have an impact on the accuracy of impedance measurements taken during test *5.1.2.3 Input Impedance* of the RT Validation Test Plan. We therefore recommend specifications similar to those of the following MIL–STD–1553 cables available through Loral Instrumentation (LI). LI part number 260052–1 is 3.3 feet (1 meter) long and is recommended for direct coupling. LI part number 260052–2 is 5 feet (1.5 meters) long and is recommended for transformer coupling. Both part numbers use the following cable: Belden 9222, RG–58A/U type triaxial cable, 20 AWG (7×28 stranding), .037 inch diameter, tinned copper, 96% shield coverage, 50Ω nominal impedance, 30.8 pF/ft (101 pF/m) nominal capacitance. Cable end–connector specifications are as follows: identical 3–lug male triaxial end–connectors at both ends. Note also that the two cables used to connect the System 300 to the RT under test must be identical in all respects, particularly length.

Notes:

Section 3

Calibration Procedures

Contents

Input Impedance Calibration Procedures 3–3

Input Impedance Calibration Fixture Reference Table 3–5

Sample Program for Input Impedance Calibration Fixture Reference Table 3–6

Noise Test Calibration Procedures 3–10

CAUTION

Use of the "Error Filter (Y, N)" and "Error Filter Data" fields of the System 300's Operation Mode Setup Page (accessed using the DISPLAY OPERATION MODE command) is restricted. These fields are to be used only in conjunction with the System 300 RT Validation Test Plan (VTP) Application Software (the "VTP Software"), Model VTP310, Version 1.3 or higher, during execution of the triservice RT Validation Test Plan. (The VTP Software is operated via an IBM PC AT–compatible microcomputer or a GRiD laptop microcomputer.) At all other times, the "Error Filter (Y, N)" field should be set to its default value of "NO," which disables the command word, status word, or data word in the "Error Filter Data" field.

System 300 users who use these two fields in the enabled mode for any purpose other than with the VTP Software during execution of the RT Validation Test Plan run the risk of generating unpredictable results. For more information on these two fields, consult the *System 300 User's Manual*, *Operating System Controller Module Manual* section, Section 3, "Operation," under the description of the DISPLAY OPERATION MODE command. For more information on the VTP Software, consult the *System 300 RT Validation Test Plan (VTP) Application Software User's Manual*.

Input Impedance Calibration Procedures

NOTE	We strongly recommend that you update the input impedance calibration fixture reference table before performing these calibration procedures. See the subsection just ahead marked "Input Impedance Calibration Fixture Reference Table."

Prior to performing the input impedance measurement test, perform the following calibration procedures. Note that the input impedance measurement test is set up using the ZIN option of the "Stimulus" field on the Electrical Stimulus Page, which is accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command (see Section 5 for a description of this command and of the ZIN option). Here are the calibration procedures:

1. Display the Electrical Stimulus Page using the DISPLAY ELECTRICAL BC TO RT STIMULUS command. The full expansion is

   DISPLAY ELEC BC TO RT STIMULUS BUS X (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using.

2. Enter the Electrical Stimulus Page and set the "BC to RT Stimulus Enable" field to **YES**.

3. Set the "Bus Coupling" field to **XFORMER** or **DIRECT**.

4. Set the "Stimulus" field to one of the following:

   ZIN 0075 KHz 1000 mV PWR ON

   or

   ZIN 0075 KHz 1000 mV PWR OFF

where the choice between **PWR ON** and **PWR OFF** depends on which paragraph of the RT Validation Test Plan you're running. Then exit the Electrical Stimulus Page by pressing (RETURN) (a carriage return).

5. Attach the input impedance calibration fixture to the System 300 at one end (at the 1553 PRI and 1553 SEC bus connectors on the High–Speed Amplifier Module), and to the RT at the other end, as described in Section 2, under "How to Hook Up the Input Impedance Calibration Fixture to the System 300 and the RT." Then set the switch on the calibration fixture to the "CALIB" position.

6. Set the System 300 EMS Calibration feature to ON by entering the command

   SET EMS CALIBRATION ON BUS X (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using.

7. Run the electrical test using the RUN ELECTRICAL MEASUREMENT command. The full expansion is

   RUN ELEC MEASUREMENT BUS X FULL (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using. (Notice that the FULL option is used rather than the FOREVER option.)

8. The following status message will display on your screen:

   ZIN Calibration: XXXX KHz

   where XXXX represents the frequency at which the input impedance is being calibrated, in kilohertz (KHz). Note that XXXX will step through the following ten frequencies as each frequency is being calibrated: 0075, 0100, 0150, 0200, 0250, 0300, 0333, 0400, 0500, 1000. These correspond to the ten frequencies that can be programmed for the ZIN option in the "Stimulus" field of the Electrical Stimulus Page—this is represented by the first variable in the ZIN expression in step 4 above (its value is 0075 in that step). Wait for the status message to step through all ten frequencies.

NOTE	Calibration of input impedance at all ten frequencies takes approximately 12 minutes. Calibration at each frequency takes approximately 1 minute and 15 seconds.

9. When the system has finished calibrating the input impedance at all ten frequencies, set the System 300 EMS Calibration feature to OFF by entering the command

   SET EMS CALIBRATION OFF BUS X (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using. Then set the switch on the input impedance calibration fixture to the "NORMAL" position. The calibration procedure is now complete.

Input Impedance Calibration Fixture Reference Table

Each input impedance calibration fixture has a corresponding reference table that contains resistance and phase–delay values measured for that particular calibration fixture. The System 300 EMS 310 Module's input impedance software includes a default reference table that can be updated using a host PC and a Symbolic Direct Memory Access (SDMA) data file. The SDMA data file contains new values for the specific calibration fixture.

You can use the sample "C" program listed in the next subsection to create this SDMA–formatted data file that you can then load into the System 300 via the host PC. (For more information on SDMA files in general, see the *System 300 User's Manual* [Part No. 722609–1], *General Operating Instructions* section, Section 5, "Protocols, Host Interfaces and Key Records.")

In brief, inserting the calibration fixture in the communications path between the System 300 and the RT under test introduces into the path an additional impedance caused by the calibration fixture itself. This impedance must be factored out in order to get a true measurement of the RT's impedance when the input impedance test is performed. The reference table provides the information to factor out, and the sample "C" program listed in the next subsection allows you to generate this reference table in the form of an SDMA data file that can then be loaded to the System 300.

As an alternative way to load this update, note that Loral Instrumentation's System 300 RT Validation Test Plan (VTP 310) Application Software contains a menu and an option for automatically updating the System 300's internal input impedance calibration fixture reference table.

Once the input impedance calibration fixture reference table has been updated, the next step is to perform the input impedance calibration procedures listed earlier in this section.

Sample Program for Input Impedance Calibration Fixture Reference Table

```
/*
 * Loral Instrumentation, San Diego, CA
 *
 * sdma.c for input impedance calibration fixture reference table
 *
 * Utility program to create an SDMA file for the System 300.  This program creates a file of
 * input impedance resistance and phase–delay values along with the required SDMA header
 * data.  The values are in string format and are floating point.  The System 300 converts the
 * input strings into binary floating point and updates its internal input impedance calibration
 * and measurement reference table.
 *
 * The format of the file is the following:
 * S#A              – Symbolic SDMA header, A = no check sum or crc.
 * lenlen           – two length bytes, entire file.
 * "ZINREF_01"      – id for data, including quotes.
 * lenlen           – two length bytes, of data only.
 * ascii strings of resistance and phase delay.  Each string is null terminated and is
 *     floating point.
 *                  – for example: 3937.13\0
 *                    26.125\0
 */

#include <stdio.h>
#include <string.h>
#include <ctype.h>
```

```
/*
 * table of default reference values taken from the calibration fixture.
 */
char *zinvals[20] = {
        /* resistance, phase delay */
        "8434.0", "40.530",          /* 75 KHz */
        "11083.0", "30.391",         /* 100 KHz */
        "14066.0", "13.740",         /* 150 KHz */
        "14800.0", "1.324",          /* 200 KHz */
        "14571.0", "-7.268",         /* 250 KHz */
        "13861.0", "-14.598",        /* 300 KHz */
        "13247.0", "-18.981",        /* 333 KHz */
        "11914.0", "-26.384",        /* 400 KHz */
        "9919.0", "-35.258",         /* 500 KHz */
        "4159.0", "-59.398"          /* 1000 KHz */
};
main()                                                          main
{
        FILE *fp;                    /* output file pointer */
        char buffer[300];            /* buffer for conversion */
        int len;                     /* len of buffer */
        int i, cnt = 0;
        /*
         * make an SDMA file of input impedance calibration reference values.
         */

        /* Get string length */
        len = sizeof(buffer);

        /*
         * SDMA block header.  A is for no check sum to accompany
         * the SDMA file.  S#Alenlen
         */
        buffer[cnt++] = 'S';
        buffer[cnt++] = '#';
        buffer[cnt++] = 'A';
        buffer[cnt++] = (len >> 8);
        buffer[cnt++] = (len & 0xff);
        /*
         * add the SDMA header id string which identifies the data content as ZINREF.
         */
```

```
strcpy(&buffer[cnt], "\"ZINREF_01\"");
cnt += 11;
len = len - (cnt + 2);
buffer[cnt++] = (len >> 8);
buffer[cnt++] = (len & 0xff);
/*
 * add the strings of each resistance and phase
 */
for (i = 0; i < 10; i++) {
        /* do resistance value */
        strcpy(&buffer[cnt], zinvals[i * 2]);
        cnt += strlen(zinvals[i * 2]);
        buffer[cnt] = '\0';
        cnt++;
        /* do phase value */
        strcpy(&buffer[cnt], zinvals[i * 2 + 1]);
        cnt += strlen(zinvals[i * 2 + 1]);
        buffer[cnt] = '\0';
        cnt++;
}
/*
 * now write the SDMA buffer, including the header, to the file that will
 * eventually be loaded into the System 300.
 */
printf("\n...Opening file: zinref.\n");
if ((fp = fopen("zinref", "w+")) == NULL) {
        perror("Can't open file: zinref");
        exit(-1);
}
printf("\n...Writing reference data to file.\n");
/* write out the buffer to the file just opened */
fwrite(buffer, sizeof(*buffer), 300, fp);
fclose(fp);
printf("\n...File closed.");
/*
 * debug printing to verify the contents of the file.
 * display in hex and character format.
 */
printf("\n\nThe following data was written to the file: zinref");
printf("\n\nHex format of data:\n");
for (i = 0; i < cnt; i++) {
```

```
                if (buffer[i] == '\0')                                    ...main
                        printf("\\0");
                else
                        printf("%X", buffer[i]);
                if (((i + 1) % 30) == 0)
                        printf("\n");
        }
        printf("\n\nCharacter format of data:\n");
        for (i = 0; i < cnt; i++) {
                if (buffer[i] == '\0')
                        printf("@");
                else
                        printf("%c", buffer[i]);
                if (((i + 1) % 50) == 0)
                        printf("\n");
        }
        printf("\n\n...END\n");
}
```

Noise Test Calibration Procedures

The noise levels selected on the Electrical Stimulus Page during execution of the electrical noise test are calibrated automatically when the RUN NOISE TEST command is executed during the test. No other calibration procedures are necessary.

For more information on how to set up and perform the electrical noise test, see the "Getting Started" section of this manual (Section 4).

Section 4

Getting Started

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How to Set Up and Perform the Electrical Noise Test 4–6

How to Operate the System 300 in the Measurement–Only Mode During Electrical Testing 4–13

CAUTION

Use of the "Error Filter (Y, N)" and "Error Filter Data" fields of the System 300's Operation Mode Setup Page (accessed using the DISPLAY OPERATION MODE command) is restricted. These fields are to be used only in conjunction with the System 300 RT Validation Test Plan (VTP) Application Software (the "VTP Software"), Model VTP310, Version 1.3 or higher, during execution of the triservice RT Validation Test Plan. (The VTP Software is operated via an IBM PC AT–compatible microcomputer or a GRiD laptop microcomputer.) At all other times, the "Error Filter (Y, N)" field should be set to its default value of "NO," which disables the command word, status word, or data word in the "Error Filter Data" field.

System 300 users who use these two fields in the enabled mode for any purpose other than with the VTP Software during execution of the RT Validation Test Plan run the risk of generating unpredictable results. For more information on these two fields, consult the *System 300 User's Manual*, *Operating System Controller Module Manual* section, Section 3, "Operation," under the description of the DISPLAY OPERATION MODE command. For more information on the VTP Software, consult the *System 300 RT Validation Test Plan (VTP) Application Software User's Manual*.

How to Perform Manual Execution of Electrical Tests

To manually execute electrical tests, perform the following:

1. Define the BC command and associated data words on the Electrical Stimulus Page, accessed by entering the following command:

   DISPLAY ELEC BC TO RT STIMULUS BUS X (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using. Make sure that you set the "BC TO RT Stimulus Enable" field of the Electrical Stimulus Page to **YES.**

2. Next, enter one of the following four commands:

   RUN ELEC MEASUREMENT BUS X FULL (RETURN) *(X = 1 to 8)*

   OR

   RUN ELEC MEASUREMENT BUS X FOREVER (RETURN) *(X = 1 to 8)*

   OR

   XMIT ELEC TEST BUS X YYYYY (RETURN) *(X = 1 to 8, YYYYY = 00000 to 65535)*

   OR

   XMIT ELEC TEST BUS X FOREVER (RETURN) *(X = 1 to 8)*

   Entering any one of these commands transmits the BC command and associated data words you programmed on the Electrical Stimulus Page, then captures a message in digitizer memory. (When you enter the command, the status message "Running Measurements" will display on your CRT screen for about 15 seconds, then disappear.)

   For the RUN ELECTRICAL MEASUREMENT command, **FULL** transmits the message once, **FOREVER** transmits the message indefinitely. For the XMIT ELECTRICAL TEST command, the numbers **00001** to **65535** specify

the exact number of times the message is transmitted. **FOREVER** and the value **00000** cause the message to be transmitted indefinitely.

For any of the four commands just listed, the last message transmitted is the message that is captured in digitizer memory and used for measurements. If the FOREVER option (or 00000) is specified, the message captured for measurements is the last message transmitted when you enter the HALT ELECTRICAL TEST command.

NOTE: If you've used the FOREVER option in the RUN ELECTRICAL MEASUREMENT command or the XMIT ELECTRICAL TEST command, or you've specified 00000 in the XMIT ELECTRICAL TEST command, then before entering the DISPLAY ELECTRICAL MEASUREMENTS command in step 3 below, enter the HALT ELECTRICAL TEST command, as follows:

HALT ELEC TEST BUS X (RETURN) *(X = 1 to 8)*

For further information on any of the commands listed in this step, see Section 5, "Operation."

3. When control is returned to the system command line, enter the following command in order to display the measurements:

DISPLAY ELEC MEASUREMENTS RT BUS X (RETURN) *(X = 1 to 8)*

The message "Calculating Measurements" will display on your screen. Approximately 15 seconds later the Electrical Measurements Page will display, a sample of which is shown in Figure 4–1.

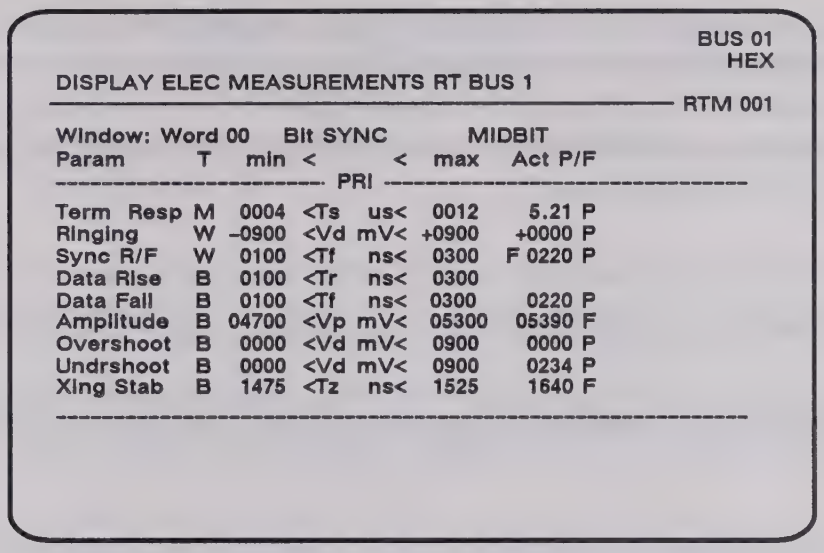
BUS 01
HEX
DISPLAY ELEC MEASUREMENTS RT BUS 1
RTM 001
Window: Word 00 Bit SYNC MIDBIT
Param T min < < max Act P/F
PRI
Term Resp M 0004 <Ts us< 0012 5.21 P
Ringing W -0900 <Vd mV< +0900 +0000 P
Sync R/F W 0100 <Tf ns< 0300 F 0220 P
Data Rise B 0100 <Tr ns< 0300
Data Fall B 0100 <Tf ns< 0300 0220 P
Amplitude B 04700 <Vp mV< 05300 05390 F
Overshoot B 0000 <Vd mV< 0900 0000 P
Undrshoot B 0000 <Vd mV< 0900 0234 P
Xing Stab B 1475 <Tz ns< 1525 1640 F

Figure 4–1. Sample Electrical Measurements Page

Each measurement on the Electrical Measurements Page is displayed with a "P" or an "F" to indicate whether that particular test passed or failed, respectively. (The Sync Rise/Fall Time is preceded by an "F" for a Fall Time or an "R" for a Rise Time. Do not confuse the Fall Time "F" with the "F" for Fail.)

To take measurements on a different word, bit, and/or edge within the captured message, enter the Electrical Measurements Page using the (↓) key, specify the new values in the "Window" field, exit the page using the (RETURN) key, and reenter the command **DISPLAY ELEC MEASUREMENTS RT BUS X** (RETURN) (X = 1 to 8).

Note that the minimum and maximum values for each measurement listed on the Electrical Measurements Page (the values in the columns labeled "min" and "max," respectively) are defaulted to the minimum and maximum values specified in the *Remote Terminal Validation Test Plan* (RT VTP). However, you can change these minimum and maximum values to specify a range of your choosing. Simply cursor to the appropriate columns and enter your desired values. See the discussion of the DISPLAY ELECTRICAL MEASUREMENTS command in Section 5 of this manual for the programmable ranges of the minimum and maximum values of each measurement. Note also that the minimum and maximum values for the zero crossing stability are defaulted to a one–half sync bit. If you change the values

in the "Window" field from these default values, you must also change the minimum and maximum values of the zero crossing stability accordingly.

For further information on any of the commands listed in this step, see Section 5, "Operation."

How to Set Up and Perform the Electrical Noise Test

To set up and execute the electrical noise test of the RT Validation Test Plan, perform the following:

1. The first step is to set up a BC (Bus Controller) Page with the information to be transmitted during the noise test. At the system command line, enter the command

   DISPLAY BC XXX BUS Y (RETURN)

   where XXX = 001 to 512 and represents the number of the BC Page you're using, and Y = 1 to 8 and represents the number of the bus you're using. We recommend you use BC Page 001 if it's available.

   Once the BC Page displays, enter the page and program it with the following values:

   a. Enter **YES** in the "BC Enable" field. This enables the BC Page.

   b. Enter your desired command word in the "Command" field. This is the command that will be transmitted during the noise test.

   c. In the "XMIT Buffer Size" field, enter the largest possible number you can enter that is not a multiple of the command word count.

d. Enter **INDEX** in the "XMIT Buffer Type" field. This specifies an index buffer, which is a circular buffer that is indexed or stepped through by the amount of the word count programmed in the command word, and wraps back to the starting address of the buffer when the end of the buffer is reached.

e. Enter **NOISE** in the "Error" field. This specifies the NOISE error injection.

f. Enter **RANDOM** in the "XMIT Buffer Data" field just above the array of data values. This selects randomized data for the data buffer.

> **NOTE** It takes approximately 25 seconds to randomize an entire or full buffer of data.

When you're finished programming the BC Page, be sure to exit the page with (RETURN).

For more information on programming BC Pages, see the description of the DISPLAY BC command in the *System 300 Simulator Module Manual*, Section 3, "Operation."

2. The next step is to program Frame Format Page A with the page number of the BC Page you have just programmed. This will cause Frame Format Page A to transmit the information on the BC Page when the noise test is executed. At the system command line, enter the command

DISPLAY FRAME FORMAT A BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

Once Frame Format Page A displays, enter the page, enter your Minor Frame Time in the top line (1000 USEC is the default value), and then enter the following two items in the upper left-hand corner of the Frame Format Array:

XXX ***

where XXX is the page number of the BC Page you programmed in step 1 above, and the three asterisks form the delimiter that indicates the end of a major frame. (You need enter only one asterisk to generate the three.) The rest of the Frame Format Array should consist of all triple-slashes: ///. (Note that the entry-number column at the far left of Frame Format Page A is not part of the Frame Format Array.)

When you're finished programming Frame Format Page A, be sure to exit the page with (RETURN).

For more information on how to program a Frame Format Page, see the description of the DISPLAY FRAME FORMAT command in the *System 300 Simulator Module Manual*, Section 3, "Operation."

3. The next step is to set up the Electrical Stimulus Page with the information that will cause the System 300's internal noise source to generate noise during the noise test, of the specified duration and amplitude. At the system command line, enter the command

DISPLAY ELEC BC TO RT STIMULUS BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

Once the Electrical Stimulus Page displays, enter the page and program it with the following values:

a. Enter **YES** in the "BC TO RT Stimulus Enable" field. This enables the Electrical Stimulus Page.

b. Enter **XFORMER** or **DIRECT** in the "Bus Coupling" field, depending on whether the RT under test is connected to the bus via a transformer-coupled stub or a direct-coupled stub, respectively.

c. Enter the following selection in the "Stimulus" field:

NOISE GATE XXX USEC YYYY mV

where XXX is the duration of the noise signal, in microseconds (USEC), and YYYY is the amplitude of the noise signal, in millivolts. Note that generation of the noise signal begins at the moment the message is transmitted. XXX can be any number from 000 to 999 inclusive, and YYYY can be any number from 0140 to 0200 inclusive. The default value for XXX is 001, and the default value for YYYY is 0140.

When you're finished programming the Electrical Stimulus Page, be sure to exit the page with (RETURN).

For more information on programming the Electrical Stimulus Page (especially the NOISE GATE option of the "Stimulus" field), see the description of the DISPLAY ELECTRICAL BC TO RT STIMULUS command in Section 5 of this manual, "Operation."

4. The next step is to verify that the bus coupling programmed on the Operation Mode Setup Page is the same as the one you just programmed on the Electrical Stimulus Page. At the system command line, enter the command

DISPLAY OPERATION MODE BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

When the Operation Mode Setup Page displays, check the "Bus Select" field and make sure that the option listed there is the same as the one you programmed for the "Bus Coupling" field of the Electrical Stimulus Page in step 3b above—either **XFORMER** or **DIRECT**. If the option is not the same, enter the page and change the option to be the same, then exit the page by pressing (RETURN).

For more information on programming the Operation Mode Setup Page, see the description of the DISPLAY OPERATION MODE command in Section 3, "Operation," of the *Operating System Controller Module Manual* portion of the *System 300 User's Manual*.

5. The final step is to run the noise test. At the system command line, enter the command

RUN NOISE TEST BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

The noise test will begin running. The Electrical Noise Test Page will display on your screen, and the noise test results will be checked periodically and the Electrical Noise Test Page updated accordingly. (For more information on how to read the Electrical Noise Test Page, consult the description of the DISPLAY ELECTRICAL NOISE TEST command in Section 5 of this manual, "Operation.")

NOTE	While the electrical noise test is running, the ACQMEM, mailbox, and activity functions are inoperable.

The noise test will run continuously until one of the following three conditions is met:

a. The test passes or fails according to the pass/fail criteria of the RT Validation Test Plan. That is, the total number of all words received by the RT under test either exceeds the required number for acceptance of the RT or is less than the required number for rejection of the RT, based on the total number of errors transmitted, as specified in Table III of the RT VTP (a copy of which appears at the end of this subsection).

b. The total number of words transmitted exceeds 330 million.

c. You exit the Electrical Noise Test Page using the **ESCAPE** or (RETURN) key and enter the **HALT NOISE TEST** command at the system command line. (You can then continue the noise test by entering the **RESUME NOISE TEST** command at the system command line.)

Finally, here are a few details on the inner workings of the System 300 when you use the RUN NOISE TEST, HALT NOISE TEST, and RESUME NOISE TEST commands while performing the noise test:

- When you enter the RUN NOISE TEST command, the counters used to track the noise test status are reset. These counters include the total number of words transmitted, the total number of NORESP (no response) errors transmitted, and the total number of MEBIT (message error bit) errors transmitted.
- When you enter the HALT NOISE TEST command, the Simulator Module is instructed to stop transmitting. None of the counters used to track the noise test status are reset.
- When you enter the RESUME NOISE TEST command, the Simulator Module is instructed to begin transmitting. None of the counters used to track the noise test status are reset.

For more information on how to use the RUN NOISE TEST, HALT NOISE TEST, and RESUME NOISE TEST commands, consult the respective descriptions of these commands in Section 5 of this manual, "Operation."

Following is a reproduction of Table III from the RT Validation Test Plan, which specifies the pass/fail criteria for the noise test.

Table 4–1. Criteria for Acceptance or Rejection of a Terminal for the Noise Rejection Tests (Table III of the RT Validation Test Plan)

	Total number of words received by the terminal (in Multiples of 10^7)	
No. Of Errors	**Reject (Equal or Less)**	**Accept (Equal or More)**
0	N/A	4.40
1	N/A	5.21
2	N/A	6.02
3	N/A	6.83
4	N/A	7.64
5	N/A	8.45
6	.45	9.27
7	1.26	10.08
8	2.07	10.89
9	2.88	11.70
10	3.69	12.51
11	4.50	13.32
12	5.31	14.13
13	6.12	14.94
14	6.93	15.75
15	7.74	16.56
16	8.55	17.37
17	9.37	18.19
18	10.18	19.00
19	10.99	19.81
20	11.80	20.62
21	12.61	21.43
22	13.42	22.24
23	14.23	23.05
24	15.04	23.86
25	15.85	24.67
26	16.66	25.48
27	17.47	26.29
28	18.29	27.11
29	19.10	27.92
30	19.90	28.73
31	20.72	29.54
32	21.53	30.35
33	22.34	31.16
34	23.15	31.97
35	23.96	32.78
36	24.77	33.00
37	25.58	33.00
38	26.39	33.00
39	27.21	33.00
40	28.02	33.00
41	33.00	N/A

How to Operate the System 300 in the Measurement-Only Mode During Electrical Testing

To operate the System 300 in the measurement–only mode during electrical testing—that is, using only the measurement features of the EMS 310 Module and not the stimulus features—perform the following steps:

1. Display the Electrical Stimulus Page and program it with the information that will disable the EMS 310 Module's stimulus features and add an extra measurement feature if desired (the nine measurements that are normally taken by the EMS 310 Module will be taken automatically). At the system command line, enter the command

   DISPLAY ELEC BC TO RT STIMULUS BUS X (RETURN)

   where X = 1 to 8 and represents the number of the bus you're using.

   Once the Electrical Stimulus Page displays, enter the page and program it as follows:

   a. Set the "BC TO RT Stimulus Enable" field to **NO**. This will disable the stimulus settings on the Electrical Stimulus Page.

   b. Select an extra measurement option in the "Measurement" field, if desired. The available options are **O/P SYM** (output symmetry), **O/P NOISE** (output noise), **O/P ISOLN** (output isolation), **FREQ Ss1** (frequency stability variable Ss1), **FREQ Ss2** (frequency stability variable Ss2), **FREQ S1** (frequency stability variable S1), **1st–HSYNC** (first–half sync bit), **Lst–HPAR** (last–half parity bit), **P/ON NOISE** (power–on noise), and **P/OFF NOISE** (power–off noise). If you do not wish to specify an extra measurement in this field, select the option **NONE**.

   c. Select the option **NONE** in the "Stimulus" field.

   When you're finished programming the Electrical Stimulus Page, be sure to exit the page with (RETURN).

   For more information on programming the Electrical Stimulus Page, see the description of the DISPLAY ELECTRICAL BC TO RT STIMULUS command in Section 5 of this manual, "Operation."

2. Set up the external signal source that will generate the 1553 waveform on the bus. Make the proper connections between the device and the System 300.

3. Run the test. At the System 300 command line, enter either of the following commands:

RUN ELEC MEASUREMENT BUS X FULL (RETURN)

OR

RUN ELEC MEASUREMENT BUS X FOREVER (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

4. ***Less than 10 seconds later, have your external signal source generate the 1553 waveform on the bus.***

Once you perform these two steps (3 and 4), the System 300 will capture both the signal generated by the external source and the response generated by the unit under test (UUT) in its electrical snapshot buffer.

When you enter either of the commands in step 3 above, the status message "Running Measurements" will display on your CRT screen for about 15 seconds, then disappear.

If you specify the **FULL** option in step 3, the System 300 continues to capture information until the electrical snapshot buffer is full. In that case, the last message received is the message that is used for measurements. If you specify the **FOREVER** option in step 3, the System 300 continues to capture information until you enter the HALT ELECTRICAL TEST command. In that case, the last message received when you enter the HALT ELECTRICAL TEST command is the message that is used for measurements.

5. If you specified the **FOREVER** option in step 3 above, then before proceeding to step 6, you must enter the HALT ELECTRICAL TEST command, as follows:

HALT ELEC TEST BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using.

If you specified the **FULL** option in step 3 above, proceed to step 6.

6. When control is returned to the system command line, you may calculate and display the measurements by entering the following command:

DISPLAY ELEC MEASUREMENTS RT BUS X (RETURN)

where X = 1 to 8 and represents the number of the bus you're using. The message "Calculating Measurements" will display on your screen and the System 300 will begin calculating the measurements on the captured waveform. Approximately 15 seconds later the Electrical Measurements Page will display, a sample of which is shown earlier, in Figure 4–1. The Electrical Measurements Page displays the results of the measurements calculated on the captured waveform, including the nine automatic measurements and the extra measurement you specified in the "Measurement" field of the Electrical Stimulus Page in step 1(b) above (if you specified an extra measurement there). This extra measurement, if specified, will be displayed directly underneath the table of nine automatic measurements. (For more information on the Electrical Measurements Page, see step 3 of "How to Perform Manual Execution of Electrical Tests" earlier in this section.)

For further information on the DISPLAY ELECTRICAL MEASUREMENTS command (and the Electrical Measurements Page), see the description of this command in Section 5, "Operation." For more information on any of the other commands listed in this procedure, also see Section 5.

Notes:

Section 5

Operation

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Xmit Electrical Test 5–46

CAUTION

Use of the "Error Filter (Y, N)" and "Error Filter Data" fields of the System 300's Operation Mode Setup Page (accessed using the DISPLAY OPERATION MODE command) is restricted. These fields are to be used only in conjunction with the System 300 RT Validation Test Plan (VTP) Application Software (the "VTP Software"), Model VTP310, Version 1.3 or higher, during execution of the triservice RT Validation Test Plan. (The VTP Software is operated via an IBM PC AT–compatible microcomputer or a GRiD laptop microcomputer.) At all other times, the "Error Filter (Y, N)" field should be set to its default value of "NO," which disables the command word, status word, or data word in the "Error Filter Data" field.

System 300 users who use these two fields in the enabled mode for any purpose other than with the VTP Software during execution of the RT Validation Test Plan run the risk of generating unpredictable results. For more information on these two fields, consult the *System 300 User's Manual*, *Operating System Controller Module Manual* section, Section 3, "Operation," under the description of the DISPLAY OPERATION MODE command. For more information on the VTP Software, consult the *System 300 RT Validation Test Plan (VTP) Application Software User's Manual*.

How to Interpret the Commands Presented in this Section

This section describes commands that are available to the System 300 when the Electrical Measurement and Stimulus (EMS 310) Module is configured into the system.

Some commands include words that you don't have to enter on the command line—i.e., the system enters them for you. For example, in all commands containing the word BUS, you don't have to enter the word BUS. The command interpreter automatically enters it for you, then skips over it so that you can enter the next word.

Here is a list of all the words and symbols that the command interpreter automatically enters for you:

UNTIL
FROM
SIZE
WITH
BUS
TO
WC
: (colon)
– (minus sign)
, (comma)
(blank space)

NOTE

When programming the System 300 for automatic operation (for example, when creating a key record or a Keyboard Language [KBL] host interface executable file), you must enter the minimum character string that will uniquely identify each command and menu selection. *Do not* use the **TAB** key to skip over fields within a command or menu selection, and *do not* use the increment and decrement keys (**F4** and **F2** or **CTRL–X** and **CTRL–Y**) to select items within the command wheel or within a menu–selection wheel. For more information on the proper way to enter commands and menu selections during system programming, see the "Note" in Section 3, "How to Use the System 300," of the *System 300 General Operating Instructions* section of the *System 300 User's Manual*. This Note appears under the subsection "How The User Interface Works," and under the sub–subsection "Using the Keyboard."

Command Description Format

Command Name

USE: *PURPOSE OF THE COMMAND*

DESCRIPTION:

A descriptive definition of what the command does.

SYNTAX: *YOUR ACTUAL ENTRIES*

```
A <BCD> 0 <123>                =        Command-Line Entry
          (description) <xx>   =        | Subcommand-Line Entry
              A <BC>           =        |
              1 <23>           =        |
                <RETURN>       =        Carriage Return --- enters command
```

FIELD NAME DESCRIPTION: *VARIABLES AND RANGES*

A detailed description of the entries.

SAMPLE DISPLAY:

Sample of a display page, if applicable.

LEGEND FOR SYNTAX:

A<BCD>	–	Items within angle brackets are automatically entered by the system; in this example, you enter the "A" and the system automatically enters the "BCD."
(description)	–	Items within parentheses contain descriptive information that you do not enter; example = (bus no. ---).
x	–	"x" is a variable character that is pre-set and pre-entered by the system; it can be left alone or changed as needed (example = 1, for bus number).

Display Electrical BC to RT Stimulus

USE: *SETS UP ELECTRICAL STIMULUS PARAMETERS*

DESCRIPTION:

Use this command to set up the waveform characteristics and other specifications for the signal to be transmitted on the bus. You can set up the waveform with the distortions required for your particular test.

SYNTAX:

D<ISPLAY> E<LEC> B<C TO RT STIMULUS>
(bus no. --) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

TYPE THE COMMAND AND PRESS THE **RETURN** KEY TO DISPLAY THE ELECTRICAL STIMULUS PAGE, A SAMPLE OF WHICH IS SHOWN IN FIGURE 5-1.

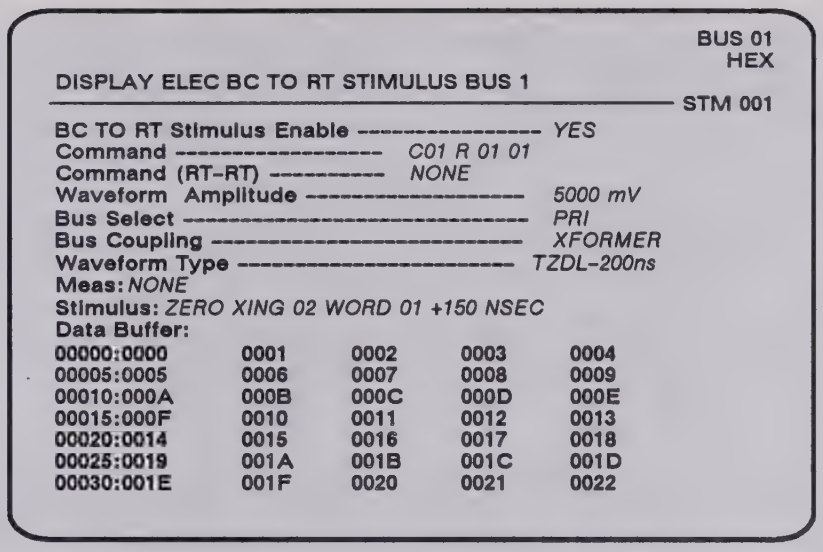
BUS 01
HEX
DISPLAY ELEC BC TO RT STIMULUS BUS 1
STM 001
BC TO RT Stimulus Enable ---------- YES
Command ---------- C01 R 01 01
Command (RT-RT) ---------- NONE
Waveform Amplitude ---------- 5000 mV
Bus Select ---------- PRI
Bus Coupling ---------- XFORMER
Waveform Type ---------- TZDL-200ns
Meas: NONE
Stimulus: ZERO XING 02 WORD 01 +150 NSEC
Data Buffer:
00000:0000 0001 0002 0003 0004
00005:0005 0006 0007 0008 0009
00010:000A 000B 000C 000D 000E
00015:000F 0010 0011 0012 0013
00020:0014 0015 0016 0017 0018
00025:0019 001A 001B 001C 001D
00030:001E 001F 0020 0021 0022

Figure 5–1. Sample Electrical Stimulus Page

ONCE YOU'VE ENTERED THE ELECTRICAL STIMULUS PAGE, YOU CAN MODIFY ANY VARIABLE FIELD AS DESCRIBED IN THE FOLLOWING:

BC TO RT STIMULUS ENABLE: *YES OR NO*

Use this field to turn on (YES) or off (NO) the stimulus features on this Electrical Stimulus Page. With the field set to NO (stimulus features disabled), the EMS 310 Module functions in the measurement mode only (for more information on this feature, see "How to Operate the System 300 in the Measurement-Only Mode During Electrical Testing" in Section 4, "Getting Started). The default value for this option is NO.

Note that when utilizing the EMS 310 Module capability with the System 300, make sure that the System 300's standard BC and RT transmission has been halted and that the BCs have been disabled. This will ensure that no two commands go out and interfere with each other.

COMMAND: *CXX X XX XX*

Specify the 1553 command word to be transmitted over the selected bus. The default command word is C01 R 01 01.

COMMAND (RT-RT): *NONE, CXX T XX XX*

If you're performing an RT-to-RT transmission, specify the second 1553 command word in the transmission. This second command *must* be a TRANSMIT command (CXX T XX XX). If you're not performing an RT-to-RT transmission, set this option to NONE. The default value for this option is NONE.

WAVEFORM AMPLITUDE: *0000 mV TO 9999 mV*

Define the amplitude, in millivolts, of the signal to be transmitted. The voltage is peak to peak, line to line. The default amplitude is 5000 millivolts.

BUS SELECT: *PRI OR SEC*

For the dual-redundant bus you specified in the "Bus Number" field of this Electrical Stimulus Page, specify which of the two buses you're using: PRI for the 1553 Primary bus, or SEC for the 1553 Secondary bus. The default value is PRI.

BUS COUPLING: *XFORMER, DIRECT, OR ISOLATED*

Select the type of RT connection or the internal (ISOLATED) mode. Select XFORMER if your RT under test is connected to the bus via a transformer-coupled stub. Select DIRECT if the RT is connected to the bus via a direct-coupled stub. Select ISOLATED if you wish to operate the System 300 internally, isolated from any external bus (an example of such use is during diagnostic tests). The default bus coupling is ISOLATED.

WAVEFORM TYPE: *SINE–1MHz, TZDL–100ns, TZDL–200ns, TZDL–300ns*

Select the shape of the waveform to be transmitted, along with its rise and fall time. The waveform shape choices are SINE (sinusoidal) or TZDL (trapezoidal), and the rise and fall time choices are 1 MHz for a sinusoidal wave, and either 100 nanoseconds, 200 nanoseconds, or 300 nanoseconds for a trapezoidal wave.

The default value for this feature is TZDL–200ns (a trapezoidal wave with a rise and fall time of 200 nanoseconds).

MEAS(UREMENT): *NONE, O/P SYM, O/P NOISE, O/P ISOLN, FREQ Ss1, FREQ Ss2, FREQ S1, 1st–HSYNC, Lst–HPAR, P/ON NOISE, P/OFF NOISE*

If desired, specify an additional electrical measurement parameter in this field, above and beyond the nine electrical measurements taken automatically by the EMS 310 Module. (The nine automatic measurements are Terminal Response Time, Ringing, Sync Rise/Fall Time, Data Rise Time, Data Fall Time, Amplitude, Overshoot, Undershoot, and Zero–Crossing Stability – see the description of the DISPLAY ELECTRICAL MEASUREMENTS command later in this section.) Note that you can specify only one additional measurement in this field per test. Also note that any option you enter in this field, other than NONE, will have priority over any option you enter in the "Stimulus" field of this Electrical Stimulus Page, other than NONE; that is, the option you specify in this field (other than NONE) will cause the option you specify in the "Stimulus" field (other than NONE) to be ignored by the System 300.

The results of the additional measurement you specify in this field will be displayed on the Electrical Measurements Page, at the bottom of the page, underneath the table of nine automatic measurements. (The Electrical Measurements Page is accessed by the DISPLAY ELECTRICAL MEASUREMENTS command.)

The default option for this field is NONE, or no additional electrical measurement parameter specified. The other options are O/P SYM (output symmetry), O/P NOISE (output noise), O/P ISOLN (output isolation), FREQ Ss1 (frequency stability Ss1), FREQ Ss2 (frequency stability Ss2), FREQ S1 (frequency stability S1), 1st-HSYNC (first-half sync), Lst-HPAR (last-half parity), P/ON NOISE (power-on noise), and P/OFF NOISE (power-off noise).

Each of the options in this field (except NONE) allows you to specify a range of values for the measurement parameter being selected by that option. This range is the pass/fail interval for the parameter. You specify a minimum value and a maximum value that the parameter can take in order to pass the test. The ranges of programmable values for both the minimum value and the maximum value are given; however, note that the maximum value you specify can never be less than the minimum value you specify.

See the RT Validation Test Plan (RT VTP) for the complete specifications of the measurement tests represented by each option in this field except 1st-HSYNC and Lst-HPAR (and NONE). The RT VTP is contained as Section 100 in MIL-HDBK-1553A. See "Implementation of Paragraph *5.1.1.10 Frequency Stability* of the RT Validation Test Plan" later in this command description for information on how the EMS 310 Module's implementation of that test differs from the implementation in the Test Plan.

Use the *O/P SYM* option (for "output symmetry") to measure the output symmetry of the waveform according to the specifications of the RT VTP. The full expansion of this option is as follows:

O/P SYM ±XXXX<Vr mV<±YYYY ZZZZ NSEC

where XXXX is the minimum value of the variable Vr (the maximum residual voltage), in millivolts, YYYY is the maximum value of Vr, also in millivolts, and ZZZZ is the waveform tail-off time (Tt), in nanoseconds.

XXXX can range from −1000 to +1000 inclusive, and the default value is −0250. YYYY can range from −1000 to +1000 inclusive, and the default value is +0250. ZZZZ can range from 0000 to 9999 inclusive, and the default value is 2500. Thus, the default expansion of this option is as follows:

O/P SYM −0250<Vr mV<+0250 2500 NSEC

specifying a pass/fail interval for the maximum residual voltage (Vr) of between −250 and +250 millivolts and a waveform tail-off time (Tt) of 2500 nanoseconds, or 2.5 microseconds.

Use the *O/P NOISE* option (for "output noise") to measure the output noise of the RT according to the specifications of the RT VTP. The full expansion of this option is as follows:

O/P NOISE ±XXXX<Vn mV<±YYYY PWR ON(/OFF)

where XXXX is the minimum value of the variable Vn (the output noise), in millivolts, YYYY is the maximum value of Vn, also in millivolts, and "PWR" can be either ON or OFF, allowing you to measure the output noise both with the RT on and with it off. (The variable Vn, as used here, is identical to the variable Vrms used in the RT VTP.) Note that the PWR ON and PWR OFF settings turn the RT under test on or off, respectively, through the "PWR KEY" connector on the rear-panel connector plate of the High-Speed Amplifier. You should connect the RT to this connector using a standard BNC cable (see Section 2).

XXXX can range from -1000 to +1000 inclusive, and the default value is +0000. YYYY can range from -1000 to +1000 inclusive, and the default value is +0014. "PWR" can be ON or OFF, and the default value is ON. Thus, the default expansion of this option is as follows:

O/P NOISE +0000<Vn mV< +0014 PWR ON

specifying a pass/fail interval for the output noise (Vn) of between 0 and 14 millivolts and RT power on.

Use the *O/P ISOLN* option (for "output isolation") to measure the output isolation of the RT according to the specifications of the RT VTP. The full expansion of this option is as follows:

O/P ISOLN ±XXXX<Is dB<±YYYY

where XXXX is the minimum value of the variable Is (the output isolation, expressed as a ratio), in decibels, and YYYY is the maximum value of Is, also in decibels.

XXXX can range from -1000 to +1000 inclusive, and the default value is +0045. YYYY can range from -1000 to +1000 inclusive, and the default value is +0050. Thus, the default expansion of this option is as follows:

O/P ISOLN +0045<Is dB< +0050

specifying a pass/fail interval for the output isolation (Is) of between 45 and 50 decibels.

Use the *FREQ Ss1* option (for "frequency stability Ss1") to measure the frequency stability parameter Ss1 of the RT according to the specifications described in "Implementation of Paragraph *5.1.1.10 Frequency Stability* of the RT Validation Test Plan" later in this command description. The full expansion of this option is as follows:

FREQ Ss1 XXXX< Ss1 <YYYY

where XXXX is the minimum value of the frequency stability variable Ss1 and YYYY is the maximum value of Ss1.

XXXX can range from 0000 to 0100 inclusive, and the default value is 0000. YYYY can range from 0000 to 0100 inclusive, and the default value is 0100. Thus, the default expansion of this option is as follows:

FREQ Ss1 0000< Ss1 <0100

specifying a pass/fail interval for the variable Ss1 of between 0 and 100.

Note that the pass criteria for Ss1 according to the RT VTP is Ss1 $\leq$ 0.01. For display purposes, the value displayed for Ss1 by the System 300 is the actual measured value multiplied by 10,000. This allows the value to be displayed as a whole number. As an example, a measured value of .005 will be displayed as 50.

Use the *FREQ Ss2* option (for "frequency stability Ss2") to measure the frequency stability parameter Ss2 of the RT according to the specifications described in "Implementation of Paragraph *5.1.1.10 Frequency Stability* of the RT Validation Test Plan" later in this command description. The full expansion of this option is as follows:

FREQ Ss2 XXXX< Ss2 <YYYY

where XXXX is the minimum value of the frequency stability variable Ss2 and YYYY is the maximum value of Ss2.

XXXX can range from 0000 to 0100 inclusive, and the default value is 0000. YYYY can range from 0000 to 0100 inclusive, and the default value is 0100. Thus, the default expansion of this option is as follows:

FREQ Ss2 0000< Ss2 <0100

specifying a pass/fail interval for the variable Ss2 of between 0 and 100.

Note that the pass criteria for Ss2 according to the RT VTP is Ss2 $\leq$ 0.01. For display purposes, the value displayed for Ss2 by the System 300 is the actual measured value multiplied by 10,000. This allows the value to be displayed as a whole number. As an example, a measured value of .005 will be displayed as 50.

Use the *FREQ S1* option (for "frequency stability S1") to measure the frequency stability parameter S1 of the RT according to the specifications described in "Implementation of Paragraph *5.1.1.10 Frequency Stability* of the RT Validation Test Plan" later in this command description. The full expansion of this option is as follows:

FREQ S1 XXXX< S1 <YYYY

where XXXX is the minimum value of the frequency stability variable S1 and YYYY is the maximum value of S1.

XXXX can range from 0000 to 1000 inclusive, and the default value is 0000. YYYY can range from 0000 to 1000 inclusive, and the default value is 1000. Thus, the default expansion of this option is as follows:

FREQ S1 0000 < S1 < 1000

specifying a pass/fail interval for the variable S1 of between 0 and 1000.

Note that the pass criteria for S1 according to the RT VTP is S1 $\leq$ 0.1. For display purposes, the value displayed for S1 by the System 300 is the actual measured value multiplied by 10,000. This allows the value to be displayed as a whole number. As an example, a measured value of .05 will be displayed as 500.

Use the *1st-HSYNC* option (for "first-half sync") to measure the first half of the sync bit of the waveform. The full expansion of this option is as follows:

1st-HSYNC $\pm$XXXX < Ty ns < $\pm$YYYY ZZZZ mV

where XXXX is the minimum value of the variable Ty (the duration of the first half of sync), in nanoseconds, YYYY is the maximum value of Ty, also in nanoseconds, and ZZZZ is the absolute value of the amplitude of the waveform, in millivolts, at the threshold at which the timing measurement begins and ends.

XXXX can range from -9999 to +9999 inclusive, and the default value is +1300. YYYY can range from -9999 to +9999 inclusive, and the default value is +1700. ZZZZ can range from 0000 to 9999 inclusive, and the default value is 0200. Thus, the default expansion of this option is as follows:

1st-HSYNC +1300 < Ty ns < +1700 0200 mV

specifying a pass/fail interval for Ty of between 1300 and 1700 nanoseconds beginning at the point at which the waveform amplitude exceeds +200 millivolts and ending at the point at which the waveform amplitude falls below -200 millivolts.

Note that when you use this option, when you run the test and then display the Electrical Measurements Page (using the DISPLAY ELECTRICAL MEASUREMENTS command), one of the following two status messages will display on the System 300 status line:

Calculated ZC level: +XXX mV

OR

Calculated ZC level: -XXX mV

Here XXX can range from 000 to 500 and represents the real, calculated zero crossing voltage level, in millivolts, of the first-half sync. The ideal zero crossing level is 0 millivolts.

Use the *Lst-HPAR* option (for "last-half parity") to measure the last half of the parity bit of the waveform. The full expansion of this option is as follows:

Lst-HPAR ±XXXX<Ty ns<±YYYY ZZZZ mV

where XXXX is the minimum value of the variable Ty (the duration of the last half of parity), in nanoseconds, YYYY is the maximum value of Ty, also in nanoseconds, and ZZZZ is the absolute value of the amplitude of the waveform, in millivolts, at the threshold at which the timing measurement begins and ends.

XXXX can range from -9999 to +9999 inclusive, and the default value is +0400. YYYY can range from -9999 to +9999 inclusive, and the default value is +0600. ZZZZ can range from 0000 to 9999 inclusive, and the default value is 0200. Thus, the default expansion of this option is as follows:

Lst-HPAR +0400<Ty ns<+0600 0200 mV

specifying a pass/fail interval for Ty of between 400 and 600 nanoseconds beginning at the point at which the waveform amplitude exceeds +200 millivolts and ending at the point at which the waveform amplitude falls below -200 millivolts.

Note that when you use this option, when you run the test and then display the Electrical Measurements Page (using the DISPLAY ELECTRICAL MEASUREMENTS command), one of the following two status messages will display on the System 300 status line:

Calculated ZC level: +XXX mV

OR

Calculated ZC level: -XXX mV

Here XXX can range from 000 to 500 and represents the real, calculated zero crossing voltage level, in millivolts, of the last-half parity. The ideal zero crossing level is 0 millivolts.

Use the *P/ON NOISE* option (for "power-on noise") to measure the power-on noise of the RT according to the specifications of the RT VTP. The full expansion of this option is as follows:

P/ON NOISE ±XXXX<Vp mV<±YYYY

where XXXX is the minimum value of the variable Vp (power-on noise), in millivolts, and YYYY is the maximum value of Vp, also in millivolts.

XXXX can range from –1000 to +1000 inclusive, and the default value is –0250. YYYY can range from –1000 to +1000 inclusive, and the default value is +0250. Thus, the default expansion of this option is as follows:

P/ON NOISE –0250<Vp mV<+0250

specifying a pass/fail interval for the power–on noise (Vp) of between –250 and +250 millivolts.

Note that when you select this option, when you run the test and then display the Electrical Measurements Page (using the DISPLAY ELECTRICAL MEASUREMENTS command), in addition to the results of the power–on measurement the following line will be listed at the bottom of the Electrical Measurements Page, underneath the table of nine automatic measurements (and directly below the power–on measurement result):

Noise Pulse Width = XX nS

Here XX can range from 00 to 99, and represents the measured time, in nanoseconds, of the noise pulse.

Use the *P/OFF NOISE* option (for "power–off noise") to measure the power–off noise of the RT according to the specifications of the RT VTP. The full expansion of this option is as follows:

P/OFF NOISE ±XXXX<Vp mV<±YYYY

where XXXX is the minimum value of the variable Vp (power–off noise), in millivolts, and YYYY is the maximum value of Vp, also in millivolts.

XXXX can range from –1000 to +1000 inclusive, and the default value is –0250. YYYY can range from –1000 to +1000 inclusive, and the default value is +0250. Thus, the default expansion of this option is as follows:

P/OFF NOISE –0250<Vp mV<+0250

specifying a pass/fail interval for the power–off noise (Vp) of between –250 and +250 millivolts.

Note that when you select this option, when you run the test and then display the Electrical Measurements Page (using the DISPLAY ELECTRICAL MEASUREMENTS command), in addition to the results of the power–off measurement the following line will be listed at the bottom of the Electrical Measurements Page, underneath the table of nine automatic measurements (and directly below the power–off measurement result):

Noise Pulse Width = XX nS

Here XX can range from 00 to 99, and represents the measured time, in nanoseconds, of the noise pulse.

STIMULUS: *NONE, ZERO, CMNMOD DC, CMNMOD FIXED, CMNMOD SWEPT 1Hz-2MHz, ZIN, NOISE GATE, EXTERNAL NOISE GATE, RIPPLE MSG ZERO XING*

If desired, specify an additional stimulus parameter. This field adds an extra stimulus condition to the signal you're generating. Note, however, that you can specify only one additional stimulus item in this field per test. Also note that if you enter an option in the "Measurement" field of this Electrical Stimulus Page, other than NONE, that option will take precedence over any option you enter in this field, other than NONE; that is, the option you enter in the "Measurement" field (other than NONE) will cause the System 300 to ignore the option you enter in this field (other than NONE).

The default option for this field is NONE, or no additional stimulus condition.

The *ZERO* condition (for "zero-crossing deviation") allows movement of a specific zero crossing within a specific word of the message to the left or the right, relative to its position on the time/voltage graph of the waveform. As a result, you will see how far you can distort the zero crossing before the RT will not validate the message.

The full expansion of this option is as follows:

ZERO XING XX WORD YY ±ZZZ NSEC

where XX is the number of the particular zero crossing you're specifying within the particular word; YY is the number of the word you're specifying within the message; and ZZZ is the positive or negative displacement, in nanoseconds, that you wish to move the zero crossing.

The values for XX (zero crossing number) range from 00 to 34 inclusive, and the default value is 02. The values for YY (word number) range from 00 to 32 inclusive, and the default value is 01. The values for ZZZ (displacement in nanoseconds) range from -250 nanoseconds to +250 nanoseconds inclusive, and the default value is +150 nanoseconds.

The full default value for this option is as follows:

ZERO XING 02 WORD 01 +150 NSEC

indicating that the second zero crossing in the first word of the message will be moved 150 nanoseconds in the positive direction.

Use the *CMNMOD DC* condition (for "Common Mode DC") to set up a common mode DC voltage level that the 1553 signal will ride on, rather than at the normal voltage level of 0 volts. The full expansion for this option is as follows:

CMNMOD DC ±XXXXX mV

where XXXXX represents the positive or negative common mode DC voltage, in millivolts. XXXXX can range from -10000 mV to +10000 mV inclusive (the equivalent of -10 V to +10 V inclusive), and the default value is +10000 mV. The default expansion is as follows:

CMNMOD DC +10000 mV

indicating that the 1553 signal will ride on a common mode DC voltage of +10000 mV.

Use the *CMNMOD FIXED* condition (for "Common Mode Fixed" frequency) to set up a fixed sinusoidal frequency at which the 1553 signal will be driven. This is an AC signal common to both 1553 lines and is added to the 1 MBPS differential signal that is the actual 1553 transmission. The full expansion for this option is as follows:

CMNMOD FIXED XXX Y ZZZZZ mV

where XXX represents the value of the fixed sinusoidal frequency, Y represents the units of the frequency (in multiples of hertz), and ZZZZZ represents the common mode AC voltage, in millivolts. XXX can range from 000 to 999 inclusive, and the default value is 002. Y can be either MHz, KHz, or Hz (megahertz, kilohertz, or hertz); the default value is MHz (megahertz). ZZZZZ can range from 0 mV to 10000 mV inclusive (the equivalent of 0 mV to 10 V inclusive), and the default value is 10000 mV. Thus, the default expansion for this option is as follows:

CMNMOD FIXED 002 MHz 10000 mV

indicating that the 1553 bus will be driven with a common mode AC voltage of 10000 mV at a fixed frequency of 2 MHz.

Use the *CMNMOD SWEPT 1Hz-2MHz* condition (for "Common Mode Swept" frequency) to select a swept sinusoidal frequency of from 1 Hz to 2 MHz at which the 1553 signal will be driven. The full expansion for this option is as follows:

CMNMOD SWEPT 1Hz-2MHz XXXXX mV

where XXXXX represents the common mode AC voltage, in millivolts. (The "1Hz-2MHz" is fixed and is part of the command.) XXXXX can range from 0 mV to 10000 mV inclusive (the equivalent of 0 mV to 10 V inclusive), and the default value is 10000 mV (10 V). Thus, the default expansion for this option is as follows:

CMNMOD SWEPT 1Hz-2MHz 10000 mV

indicating that the 1553 signal will be driven with a common mode AC voltage of 10000 mV and swept from 1 Hz to 2 MHz.

Use the *ZIN* condition (Z for "impedance," IN for "input") to measure the input impedance of the RT in accordance with the specifications of the RT VTP. The full expansion of this option is as follows:

ZIN XXXX KHz 1000 mV PWR ON(/OFF)

where XXXX is the numerical value of the frequency, in kilohertz, and the amplitude is 1000 millivolts. "PWR" can be ON or OFF, allowing you to measure the input impedance when the RT is on and when it is off.

XXXX can take the following values: 0075, 0100, 0150, 0200, 0250, 0300, 0333, 0400, 0500, 1000. The default value is 0075. The amplitude is fixed at 1000 millivolts (1 V). "PWR" can be ON or OFF, and the default value is OFF. Thus, the default expansion of this option is as follows:

ZIN 0075 KHz 1000 mV PWR OFF

specifying a sinusoidal waveform of frequency 75 KHz with amplitude 1000 mV (1 V) and with RT power OFF.

Note that the PWR ON and PWR OFF settings in this option turn the RT under test on or off, respectively, through the "PWR KEY" connector on the rear-panel connector plate of the High-Speed Amplifier Module. You should connect the RT to this connector using a standard BNC cable (see Section 2). Also, after you select this ZIN condition and before you run the electrical test (using the RUN ELECTRICAL MEASUREMENT command), you must calibrate the external input impedance calibration fixture. See the input impedance calibration procedures in Section 3.

When you use the ZIN condition and you also specify NONE in the "Measurement" field of this Electrical Stimulus Page, the following measurements will be listed on the Electrical Measurements Page after you run the test and then display that page with the DISPLAY ELECTRICAL MEASUREMENTS command (the measurements will be listed underneath the table of nine automatic measurements):

ZIN XXXX KHz 1000 mV PWR ON/OFF P/F
R = U ohms
P = V degrees
Z = W ohms

The top line of this group is an exact replica of the information you programmed for the ZIN condition in the "Stimulus" field of this Electrical Stimulus Page, except that now either "P" or "F" appears to the right depending on whether the test passed or failed, respectively. R is the apparent resistance, measured in ohms. P is the phase shift, measured in degrees. Z is the input impedance, measured in ohms. U, V, and W are all real numbers (floating-point decimals). The pass criterion for the measurement (input impedance) is $Z \geq 1000$ ohms for transformer-coupled stubs or $Z \geq 2000$ ohms for direct-coupled stubs.

Use the *NOISE GATE* condition to set up the internal noise signal to be generated in order to run the noise rejection test in accordance with the specifications of the RT VTP. The full expansion of this option is as follows:

NOISE GATE XXX USEC YYYY mV

where XXX is the duration of the noise signal, in microseconds (USEC), and YYYY is the amplitude of the noise signal, in millivolts. Note that generation of the noise signal begins at the moment the message is transmitted. This option specifies an internal noise gate for controlling the internal noise source, and sets the "NOISE GATE" connector on the rear-panel connector plate of the Digitizer module to the TTL output, active high mode (see Section 2).

XXX can range from 000 to 999 inclusive, and the default value is 001. YYYY can range from 0140 to 0200 inclusive, and the default value is 0140. Thus, the default expansion of this option is as follows:

NOISE GATE 001 USEC 0140 mV

specifying a noise signal with a duration of 1 microsecond and an amplitude of 140 millivolts.

Use the *EXTERNAL NOISE GATE* condition to specify an external device (external noise gate) that will control the generation by the internal noise source of the noise required for the noise rejection test in accordance with the specifications of the RT VTP. The full expansion of this option is as follows:

EXTERNAL NOISE GATE

There are no parameters for this option, and thus the above expansion is the default expansion. This option sets the "NOISE GATE" connector on the rear-panel connector plate of the Digitizer module to the TTL input, active high mode. Connect the external noise gate to the "NOISE GATE" connector using a standard BNC cable (see Section 2).

Use the *RIPPLE MSG ZERO XING* condition (for "Ripple Message Zero Crossing") to inject a zero crossing deviation that ripples through the test message. This allows you to perform rapid testing of zero crossing deviation tolerances at every zero crossing in the message (explained further below). The full expansion for this option is as follows:

RIPPLE MSG ZERO XING ±XXX NSEC

where XXX is the numerical value of the zero crossing deviation, in nanoseconds. XXX can range from −250 to +250 inclusive, and the default value is +150. Thus, the default expansion of this option is as follows:

RIPPLE MSG ZERO XING +150 NSEC

specifying a zero crossing deviation of 150 nanoseconds in the positive direction to be rippled through the test message.

Here's how this feature works: Suppose you run this test having specified that the test message is to be transmitted once, using the command XMIT ELEC TEST BUS 1 00001, for example. In actuality, the test message will be transmitted enough times so that the zero crossing deviation you have specified will be rippled through or "walked through" the message bit by bit, and the transmission will end when the last bit in the message has been rippled through. In other words, the sequence (1) deviate the zero crossing, (2) transmit the message once, and (3) return the zero crossing to normal, is repeated for each of the n × 34 zero crossings in the message (where n = the number of words in the message), in consecutive order starting with the first zero crossing in the message and ending with the last zero crossing in the message.

Now suppose you run this test having specified that the test message is to be transmitted 10 times, using the command XMIT ELEC TEST BUS 1 00010, for example. The sequence just described will be slightly modified to (1) deviate the zero crossing, (2) transmit the message 10 times, and (3) return the zero crossing to normal, and will again be repeated for each of the n × 34 zero crossings in the message (where n = the number of words in the message), in consecutive order starting with the first zero crossing in the message and ending with the last zero crossing in the message. In other words, the zero crossing deviation you have specified is again rippled through or "walked through" the test message bit by bit, but the message is transmitted 10 times for each zero crossing deviation, rather than just once as in the previous example.

Note that it takes approximately 1 minute and 55 seconds to transmit one 32-word message one time using the RIPPLE MSG ZERO XING condition. It takes 2 minutes and 4 seconds to transmit the same 32-word message two times; it takes 10 minutes to transmit the message 100 times; and it takes 32 minutes to transmit the message 1000 times.

DATA BUFFER: *RANDOM OR BLANK*

At the bottom of the Electrical Stimulus Page you will see an array that represents the contents of an output data buffer. This data buffer contains the data word values to be transmitted with the command defined on this Electrical Stimulus Page. (NOTE: This buffer is different from the transmit buffer associated with the System 300 Simulator Module.)

The output data buffer is arranged in five columns of data words, each data word consisting of four hexadecimal characters. An extra column at the far left displays addresses consisting of five decimal characters each, and incrementing by 5 (decimal) with each line. These addresses are the addresses of the data words in the first data column on the left. You can change the address at the top of this address column, but only this address. For this top address you can enter values of from 00000 to 00029 inclusive. If you enter an address greater than 00029, the system will default to 00029. When you change this top address, all the other addresses in the address column are instantly updated, as are all the data words in the data array.

There are 64 data words in the data buffer, ranging in value from 0000 to 003F hexadecimal (0 to 63 decimal). If the "Data Buffer" field is left blank, the data word values will be arranged in order from 0000 to 003F hexadecimal, reading left to right, then top to bottom. If the "Data Buffer" field is set to RANDOM, the data word values will be randomized, and will fill the 64 addresses in random order. The default value for the "Data Buffer" field is blank.

To customize the data word values in the output data buffer to your own needs, while in the Electrical Stimulus Page simply cursor down and over to the data words, and enter your desired value for each one. (To access data words below the visibility of your screen, change the address at the top of the address column, as described earlier.)

IMPLEMENTATION OF PARAGRAPH *5.1.1.10 FREQUENCY STABILITY* OF THE RT VALIDATION TEST PLAN:

Following is a reproduction of paragraph *5.1.1.10 Frequency stability* of the RT Validation Test Plan:

> 5.1.1.10 Frequency stability. The purpose of this test is to verify that the transmitter clock in the UUT has the proper accuracy and long term stability and proper short term stability. The transmitter clock measured shall be either the main oscillator output or an appropriate derivative of that clock (e.g., either the 16 MHz oscillator or the 1–2 MHz transmitter shift clock). The test sequence shown below shall be performed on the clock output whose ideal frequency is Fi.
>
> Step 1. The short term transmitter clock frequency shall be measured for a single period of the waveform.
>
> Step 2. Repeat step 1 for at least 10,000 samples and record the minimum (Fsmin) and the maximum (Fsmax) frequency from the samples taken.
>
> Step 3. The transmitter clock frequency shall be measured with a gate time of 0.1 s and the mean frequency for at least 1,000 samples (Fav) shall be recorded.
>
> The pass criteria shall be:
>
> Step 1 and step 2 — $Ss1 = 100\ (Fsmax - Fav)/Fav \leq 0.01$ and
> $Ss2 = 100\ (Fav - Fsmin)/Fav \leq 0.01$;
>
> Step 3 — the magnitude of $S1 = 100\ (Fav - Fi)/Fi \leq 0.1$. Record Ss1, Ss2 and S1.

The EMS 310 Module's implementation of this paragraph of the Test Plan differs from the Test Plan implementation in the number of samples taken. Because each sample requires approximately 30 seconds for the frequency measurement to be calculated, the EMS 310 Module uses only 10 samples.

Ss1

The variable Ss1 determines the difference between the average frequency and the maximum frequency. The EMS 310 Module implements this portion of the Test Plan as follows:

1. One BC command is transmitted to determine the amplitude of the RT response.

2. The same BC command is sent out 10 times. The second half of the Status response SYNC bit is measured each time. (The resolution is 10 nanoseconds.)

3. The average and maximum values are determined and are used in the following equation:

$$Ss1 = 10^6 \times [Fs(max) - Fs(ave)]/Fs(ave)$$

The result displayed is multiplied by 10^6 to make the answer greater than 1. In this format, the pass criteria for Ss1 is $Ss1 \leq 100$.

Ss2

The variable Ss2 determines the difference between the average frequency and the minimum frequency. The EMS 310 Module implements this portion of the Test Plan as follows:

1. One BC command is transmitted to determine the amplitude of the RT response.

2. The same BC command is sent out 10 times. The second half of the Status response SYNC bit is measured each time. (The resolution is 10 nanoseconds.)

3. The average and minimum values are determined and are used in the following equation:

$$Ss2 = 10^6 \times [Fs(ave) - Fs(min)]/Fs(ave)$$

The result displayed is multiplied by 10^6 to make the answer greater than 1. In this format, the pass criteria for Ss2 is $Ss2 \leq 100$.

S1

The variable S1 determines the difference between the average frequency and the ideal frequency. The EMS 310 Module implements this portion of the Test Plan as follows:

1. One BC command is transmitted to determine the amplitude of the RT response.

2. The same BC command is sent out 10 times. The second half of the Status response SYNC bit is measured each time. (The resolution is 10 nanoseconds.)

3. The average value is determined and used in the following equation:

$$S1 = 10^6 \times [Fs(ave) - Fs(ideal)]/Fs(ideal)$$

The result displayed is multiplied by 10^6 to make the answer greater than 1. In this format, the pass criteria for S1 is $S1 \leq 1000$.

Display Electrical Measurements

USE: *SETS UP MEASUREMENT PASS/FAIL LIMITS; DISPLAYS ELECTRICAL TEST RESULTS*

DESCRIPTION:

Use this command to specify a particular segment of the 1553 message you want to analyze (specify a "window" of that message), set the pass/fail limits for the measurements you want to take in running the electrical test, and, after you've run the test, actually take the measurements and display the results—including whether the individual tests passed or failed. You can do this for a remote terminal (RT) under test. All activity takes place on the bus you specify in this command.

The window analyzed is specified by the word number within the message, the bit number within that word, and the edge within that bit.

There are nine measurements for which you can set the pass/fail limits. The results of these measurements are then displayed automatically when you display this Electrical Measurements Page after running the electrical test. These nine measurements are always taken when you run the electrical test.

NOTE: After you enter the DISPLAY ELECTRICAL MEASUREMENTS command, it takes about 45 to 50 seconds for the results to come up on your screen. This is the time required for the measurements to be computed and analyzed by the system. During this time, the following message is displayed on your screen to inform you that the measurements are being calculated: "Calculating Measurements."

SYNTAX:

D<ISPLAY> E<LEC> M<EASUREMENTS> R<T>
(bus no. —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

TYPE THE COMMAND AND PRESS THE **RETURN** KEY TO DISPLAY THE ELECTRICAL MEASUREMENTS PAGE, A SAMPLE OF WHICH IS SHOWN IN FIGURE 5–2.

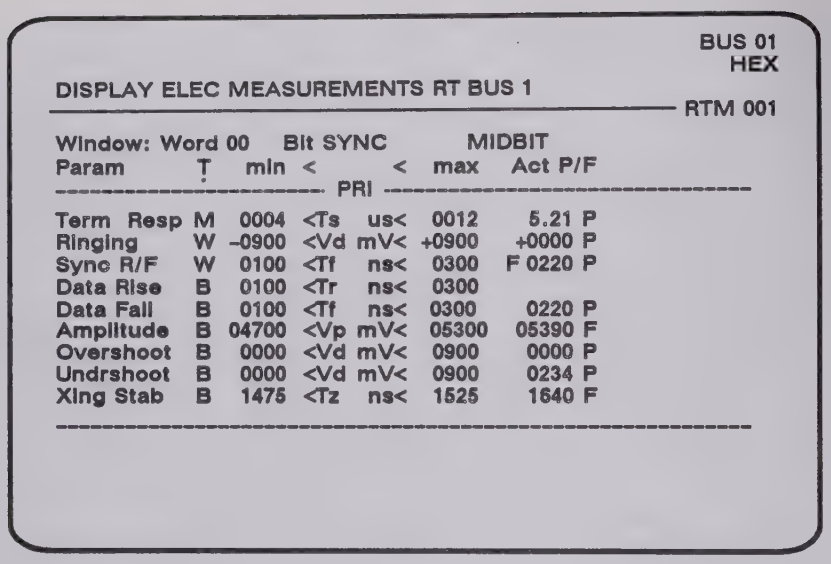
BUS 01
HEX
DISPLAY ELEC MEASUREMENTS RT BUS 1
RTM 001
Window: Word 00 Bit SYNC MIDBIT
Param T min < < max Act P/F
PRI
Term Resp M 0004 <Ts us< 0012 5.21 P
Ringing W -0900 <Vd mV< +0900 +0000 P
Sync R/F W 0100 <Tf ns< 0300 F 0220 P
Data Rise B 0100 <Tr ns< 0300
Data Fall B 0100 <Tf ns< 0300 0220 P
Amplitude B 04700 <Vp mV< 05300 05390 F
Overshoot B 0000 <Vd mV< 0900 0000 P
Undrshoot B 0000 <Vd mV< 0900 0234 P
Xing Stab B 1475 <Tz ns< 1525 1640 F

Figure 5–2. Sample Electrical Measurements Page

ONCE YOU'VE ENTERED THE ELECTRICAL MEASUREMENTS PAGE, YOU CAN MODIFY ANY VARIABLE FIELD AS DESCRIBED IN THE FOLLOWING:

WINDOW:

This is the area of the message you're going to isolate, analyze, and take the measurements from. Specify a portion of bus activity by entering a word number (the number of the word within the message), a bit number (the number of the bit within the specified word), and an edge selection (the edge within the specified bit), as follows:

WORD: *00 TO 34*

Enter the number of the word you want to isolate within the captured 1553 message. This allows you to restrict the area you want to take the measurements from. The default word number is 00 (the command word).

BIT: *SYNC, 01 TO 16, PARITY*

Enter the name or number of the bit you want to isolate within the word you've specified. This allows you to further restrict the area you want to take the measurements from. The default bit is the SYNC bit.

EDGE SELECTION: *LEADING, MIDBIT, TRAILING*

Enter the particular edge you want to isolate within the bit you've specified. This allows you to even further restrict the area you want to take the measurements from, and is the lowest level of specification. The default edge is the MIDBIT edge.

TABLE OF MEASUREMENTS:

The rest of the Electrical Measurements Page lists a table of measurements, including the names of the measurement parameters, their pass/fail limits, the actual values of the measurements taken as a result of the last electrical test performed, and whether these measurements passed or failed their respective tests.

There are five columns in this table. The first one, labeled "Param" for parameters, lists the names of the nine measurement parameters automatically taken each time the electrical test is performed. These are **Term Resp** (Terminal Response Time), **Ringing**, **Sync R/F** (Sync Rise/Fall Time), **Data Rise** (Data Rise Time), **Data Fall** (Data Fall Time), **Amplitude**, **Overshoot**, **Undrshoot** (Undershoot), and **Xing Stab** (Zero Crossing Stability). (See "How the Module Calculates Rise and Fall Times" later in this command description.)

The second column, labeled "T" for type, lists the type of measurement that the measurement represents. There are three types of measurements: M is for message–based measurement, W is for word–based measurement, and B is for bit–based measurement. A message–based measurement is taken over the entire message; a word–based message is taken over the isolated word; and a bit–based measurement is taken over the isolated bit.

The third column in the table is three columns in one. The leftmost column, labeled "min," contains the minimum acceptable values for the measurement parameters. The rightmost column, labeled "max," contains the maximum acceptable values for the measurement parameters. The column in the middle, having no label, contains the variable names of the measurement parameters, as taken from the RT Validation Test Plan, and the units of measurement for those parameters.

The minimum and maximum values of a measurement define the pass/fail limits for that measurement. If the measurement falls within the interval defined by the two values, it passes the test. If it falls outside the interval, it fails the test. The minimum and maximum values themselves are considered part of the interval and are therefore passing values. These minimum and maximum values are changeable by you. The default versions of these values are taken directly from the RT Validation Test Plan.

The fourth column in the table, labeled "Act," lists the actual values of the measurements taken following the execution of the electrical test. In the case of the Sync Rise/Fall Time, the actual value will be preceded by an R if it is a rise time, and by an F if it is a fall time.

The fifth column, labeled "P/F," lists the pass/fail status of the actual value – P for pass and F for fail. If the actual value falls within the interval specified by the minimum and maximum values, it passes the test and a P is generated; if it falls outside that interval, it fails the test and an F is generated.

Following are detailed descriptions of the individual measurement parameters listed in the table of measurements.

> **NOTE** The maximum value you specify for a measurement parameter can never be less than the minimum value you specify.

TERMINAL RESPONSE TIME: *MIN: 0001 µs TO 9999 µs*
MAX: 0001 µs TO 9999 µs

The Terminal Response Time is the time it takes for the tested device to respond after the command message has been sent. This time is measured from the last zero crossing of the parity bit of the message to the first zero crossing of the sync bit of the status response. Terminal Response Time is a message–based measurement.

The default values for the minimum and maximum terminal response times defining the pass/fail window are 0004 microseconds for the minimum and 0012 microseconds for the maximum, as they are in the RT Validation Test Plan. You can change this window according to your testing needs.

RINGING: *MIN: –2000 mV TO + 2000 mV*
MAX: –2000 mV TO + 2000 mV

Ringing is extra oscillation that takes place on the bus immediately after the 1553 message is sent. It is the level of "aftershock" or "echo" on the bus following the message, and is measured in millivolts. Ringing is measured for the word specified in the "Word" subfield of the "Window" field at the top of this Electrical Measurements Page.

The default values for the minimum and maximum ringing amplitudes defining the pass/fail window are –0900 millivolts for the minimum and + 0900 millivolts for the maximum. You can change this pass/fail window according to your testing needs.

SYNC RISE/FALL TIME: *MIN: 0000 ns TO 1000 ns*
MAX: 0000 ns TO 1000 ns

The Sync Rise/Fall Time is the rise time or fall time of the sync bit. This is a word–based measurement: It is measured for the word specified in the "Word" subfield of the "Window" field at the top of this Electrical Measurements Page. Preceding the actual value for the Sync Rise/Fall Time measurement on the measurement table is an 'R' if the value is a rise time and an 'F' if it is a fall time. (See "How the Module Calculates Rise and Fall Times" later in this command description.)

The default values for the minimum and maximum sync rise/fall times defining the pass/fail window are 0100 nanoseconds for the minimum and 0300 nanoseconds for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

DATA RISE TIME: *MIN: 0000 ns TO 1000 ns*
MAX: 0000 ns TO 1000 ns

The Data Rise Time is the rise time of the data bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page, if a rise time exists at that bit. The Data Rise Time and Data Fall Time measurements are mutually exclusive: you will have one or the other but not both. (See "How the Module Calculates Rise and Fall Times" later in this command description.)

The default values for the minimum and maximum data rise times defining the pass/fail window are 0100 nanoseconds for the minimum and 0300 nanoseconds for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

DATA FALL TIME: *MIN: 0000 ns TO 1000 ns*
MAX: 0000 ns TO 1000 ns

The Data Fall Time is the fall time of the data bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page, if a fall time exists at that bit. The Data Rise Time and Data Fall Time measurements are mutually exclusive: you will have one or the other but not both. (See "How the Module Calculates Rise and Fall Times" later in this command description.)

The default values for the minimum and maximum data fall times defining the pass/fail window are 0100 nanoseconds for the minimum and 0300 nanoseconds for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

AMPLITUDE: *MIN: 00000 mV TO 35000 mV*
MAX: 00000 mV TO 35000 mV

This is the measured amplitude, in millivolts, of the waveform at the bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page.

The default values for the minimum and maximum amplitudes defining the pass/fail window are 04700 millivolts for the minimum and 05300 millivolts for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

OVERSHOOT: *MIN: 0000 mV TO 2000 mV*
MAX: 0000 mV TO 2000 mV

This is the amount of amplitude that the waveform "overshoots" (exceeds or falls outside of) the calculated trend line following a rise or fall, the calculated trend line being the level that the waveform is expected to reach following a rise or fall. Overshoot is measured in positive millivolts (it is an absolute value). The measurement is bit-based: it is taken at the bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page.

The default values for the minimum and maximum overshoot measurements defining the pass/fail window are 0000 millivolts for the minimum and 0900 millivolts for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

UNDERSHOOT: *MIN: 0000 mV TO 2000 mV*
MAX: 0000 mV TO 2000 mV

This is the amount of amplitude that a waveform "undershoots" (dips back inside of) the calculated trend line after an overshoot. When a waveform overshoots the trend line following a rise or fall, it dips back inside of the trend line before coming back up or down and leveling off at the trend line. This initial undershoot following the first overshoot is what's measured here. Undershoot is measured in positive millivolts (it is an absolute value). The measurement is bit-based: it is taken at the bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page. NOTE: You cannot have an undershoot condition without an overshoot condition.

The default values for the minimum and maximum undershoot measurements defining the pass/fail window are 0000 millivolts for the minimum and 0900 millivolts for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

ZERO-CROSSING STABILITY (XING STAB): *MIN: 0000 ns TO 3000 ns*
MAX: 0000 ns TO 3000 ns

Zero-Crossing Stability measures the elapsed time between two successive zero crossings (or the "distance" between two adjacent zero crossings on the time/voltage graph of the waveform). It is desired that this time be stable. The two zero crossings used in the measurement are the zero crossing selected in the "Window" field at the top of this Electrical Measurements Page (LEADING, TRAILING, or MIDBIT) and the immediately preceding zero crossing in the waveform. The measurement is bit-based: it is taken at the bit you've selected in the "Bit" subfield of the "Window" field at the top of this Electrical Measurements Page.

Zero-Crossing Stability is measured to within a 10-nanosecond resolution, and it usually comes out to be a multiple of 500 nanoseconds: either 500 ns, 1000 ns, 1500 ns, or, in the case of the SYNC bit only, 2000 ns.

The default values for the minimum and maximum zero-crossing stability measurements defining the pass/fail window are 1475 nanoseconds for the minimum and 1525 nanoseconds for the maximum. These are the values listed in the RT Validation Test Plan. You can change this pass/fail window according to your testing needs.

ADDITIONAL MEASUREMENT (LISTED DIRECTLY UNDER TABLE OF NINE AUTOMATIC MEASUREMENTS):

If you specified an additional measurement in the Measurement ("Meas") field of the Electrical Stimulus Page, the results of that measurement will be displayed on this page, directly underneath the table of nine automatic measurements. The additional measurement will be displayed in the following format:

[Measurement] Value P/F

where "[Measurement]" is an exact replica of what was entered in the Measurement field of the Electrical Stimulus Page, "Value" is the measured value of the measurement parameter, and "P/F" will be either P or F depending on whether the measurement passed or failed, respectively.

Note that, except for some minor spacing considerations, the column headings in the table of nine automatic measurements will apply to the elements of the additional measurement.

The possible choices for additional measurements that can be listed here, corresponding to the possible additional measurements that can be selected in the Measurement field of the Electrical Stimulus Page, are O/P SYM (output symmetry), O/P NOISE (output noise), O/P ISOLN (output isolation), FREQ Ss1 (frequency stability Ss1), FREQ Ss2 (frequency stability Ss2), FREQ S1 (frequency stability S1), 1st-HSYNC (first-half sync), Lst-HPAR (last-half parity), P/ON NOISE (power-on noise), and P/OFF NOISE (power-off noise).

Note that when P/ON NOISE (power-on noise) or P/OFF NOISE (power-off noise) is selected in the Measurement field of the Electrical Stimulus Page, in addition to the additional measurement for that parameter, as described above, the following line will be listed in this area of the Electrical Measurements Page, just underneath the additional measurement:

Noise Pulse Width = XX nS

where XX can range from 00 to 99, and represents the measured time, in nanoseconds, of the noise pulse.

Also note that if you select either 1st-HSYNC (first-half sync) or Lst-HPAR (last-half parity) in the Measurement field of the Electrical Stimulus Page, one of the following two status messages will be displayed on the System 300 status line when you display this Electrical Measurements Page:

Calculated ZC level: +XXX mV

OR

Calculated ZC level: -XXX mV

where XXX can range from 000 to 500, and represents the real, calculated zero crossing voltage level, in millivolts, of the specified measurement. The ideal zero crossing level is 0 millivolts.

Finally, there is one case in which the result of an additional stimulus parameter is listed here. If you specify the ZIN condition in the "Stimulus" field of the Electrical Stimulus Page and you specify NONE in the "Measurement" field of that same page, the following measurements are listed when you display the Electrical Measurements Page:

ZIN XXXX KHz 1000 mV PWR ON/OFF P/F
R = U ohms
P = V degrees
Z = W ohms

The top line is an exact replica of the information programmed in the "Stimulus" field of the Electrical Stimulus Page, except that now either "P" or "F" will appear to the right depending on whether the test passed or failed, respectively.

R is the apparent resistance, measured in ohms. P is the phase shift, measured in degrees. Z is the input impedance, measured in ohms. U, V, and W are all real numbers (floating-point decimals).

The pass criterion for this measurement (input impedance) is $Z \geq 1000$ ohms for transformer-coupled stubs or $Z \geq 2000$ ohms for direct-coupled stubs.

HOW THE MODULE CALCULATES RISE AND FALL TIMES

The EMS 310 Module calculates rise and fall times as follows. As the module's software takes the various measurements of a waveform, it determines the peak voltages. In the example shown in Figure 5-3, the peak voltages are measured with respect to the zero crossing level. The software records both the maximum (highest) and minimum (lowest) values. It then calculates the 10% and 90% values from the maximum and minimum values using the formulas shown in the figure.

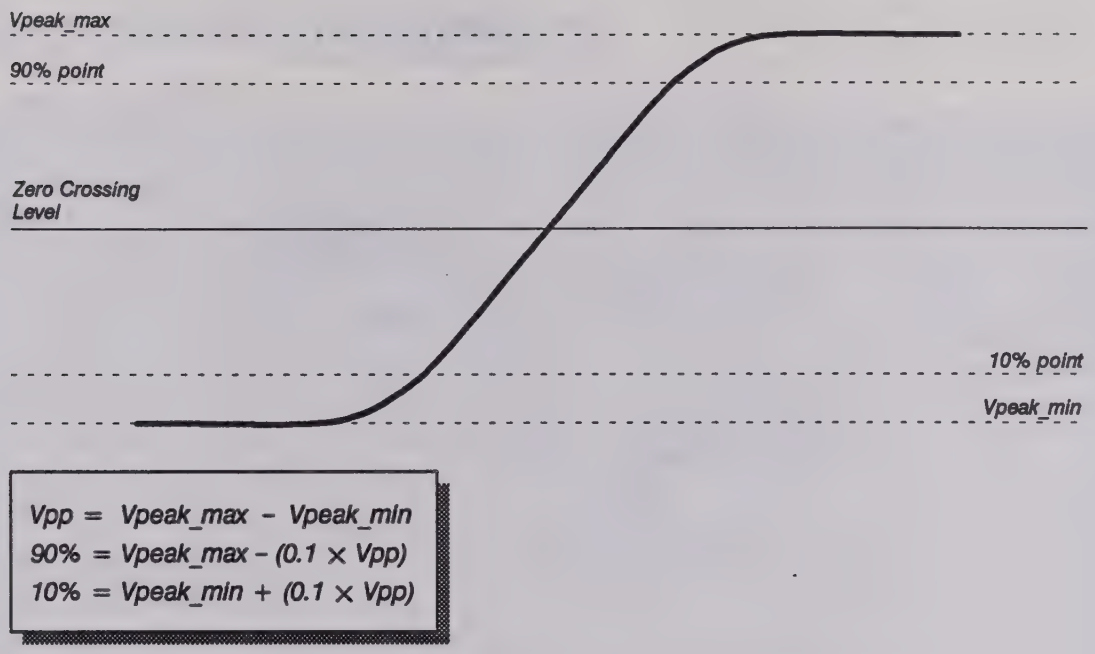

Figure 5–3. Rise Time 10% and 90% Calculations

Once the 10% and 90% values have been determined, the software then calculates the number of samples that lie between the two points. Using this information and the known slope and location within the waveform, the software then calculates the time in nanoseconds by multiplying the number of samples by 10 nanoseconds.

Sometimes the rise and fall time measurements are taken on a waveform that has some irregularities or that shows sample rate skewing. Figure 5–4 shows a waveform that has several samples of the same value at the 90% point. In looking for the 10% and 90% values, the software always searches forward or backward from the zero crossing level, the direction of search depending on the slope and the value being searched for. For positive slope, the software searches in the forward direction for the 90% value and in the backward direction for the 10% value. For negative slope, the software searches in the backward direction for the 90% value and in the forward direction for the 10% value. The value used for the calculation is the first sample value found that matches or exceeds the known 10% or 90% value, whichever is being searched for. In the example shown in Figure 5–4, the software takes the first sample value found in the forward direction that matches or exceeds the known 90% value (in this case it matches the value). This in turn may cause the measured rise time to appear to be fast, reflected in a low number of nanoseconds. The same may be true for the 10% point.

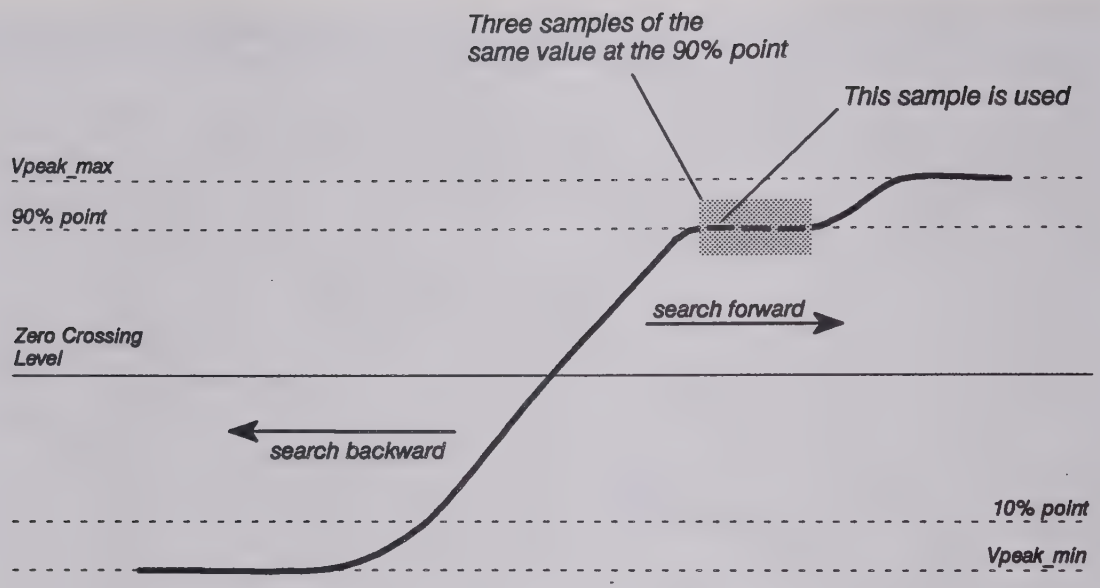

Figure 5–4. Rise Time 90% Location Skew

The rise and fall time measurements can be taken at any point in the waveform. This point is selected by the user in the "Window" field of this Electrical Measurements Page, described earlier in this command description.

This discussion has been for one case, that of a peak–to–peak rise time. The same discussion can be applied to both a peak–to–peak fall time and the first half of the sync pattern.

Display Electrical Noise Test

USE: *DISPLAYS NOISE TEST STATUS AND RESULTS*

DESCRIPTION:

Use this command to display the Electrical Noise Test Page for the specified bus. The Electrical Noise Test Page contains information on the noise test—specifically, it contains the test status (whether the test is running or has been halted), the test result (whether the test has passed or failed or is still running and has insufficient results to pass or fail), the total number of words transmitted, the total number of MEBIT (message error bit) errors, the total number of NORESP (no response) errors, and the total number of errors (which equals the total number of MEBIT errors plus the total number of NORESP errors).

SYNTAX:

D<ISPLAY> E<LEC> N<OISE TEST>
(bus no. —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

TYPE THE COMMAND AND PRESS THE **RETURN** KEY TO DISPLAY THE ELECTRICAL NOISE TEST PAGE, A SAMPLE OF WHICH IS SHOWN IN FIGURE 5-5.

USE THE **DOWN ARROW** KEY TO ENTER THE ELECTRICAL NOISE TEST PAGE AND MONITOR THE RESULTS OF THE NOISE TEST WHILE IT IS RUNNING. THE PAGE WILL BE UPDATED CONTINUOUSLY UNTIL YOU PRESS **ESCAPE** OR **RETURN** TO EXIT THE PAGE.

Note that the electrical noise test page is automatically displayed and entered for you when you execute the RUN NOISE TEST command—see the description of this command later in this section.

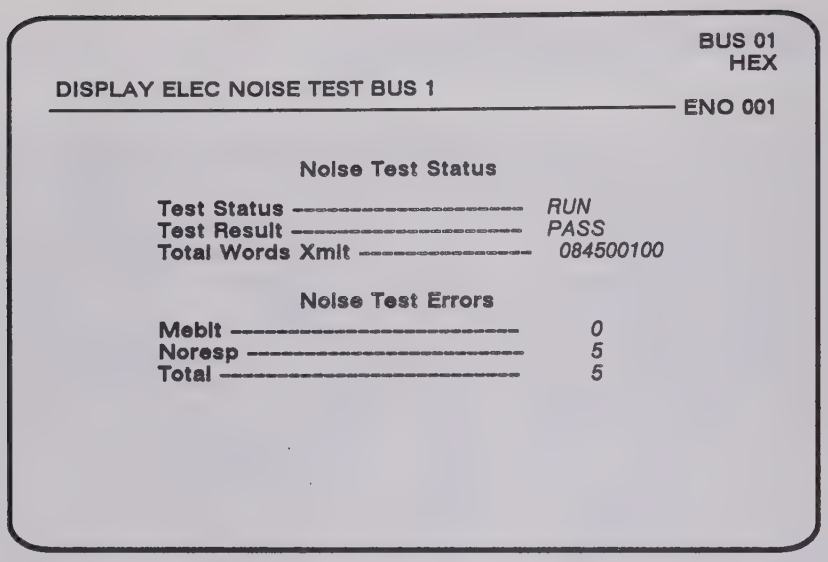

Figure 5–5. Sample Electrical Noise Test Page

THE FOLLOWING IDENTIFIES THE INFORMATION THAT APPEARS ON THE ELECTRICAL NOISE TEST PAGE:

NOISE TEST STATUS:

TEST STATUS: *RUN OR HALT*

This is the status of the noise test, whether it is running or has been halted.

TEST RESULT: *PASS, FAIL, OR NONE*

This is the outcome of the noise test. PASS indicates that it has passed, FAIL that it has failed, and NONE that there are not enough test results for the test to pass or fail. Refer to Table III of the *RT Validation Test Plan* for the pass/fail criteria for this test.

TOTAL WORDS XMIT: *0000000000 TO 9999999999*

This is the total number of words—command words and data words—that have been transmitted.

NOISE TEST ERRORS:

MEBIT: *0 TO 9999*

This is the total number of MEBIT errors that have been detected.

NORESP: *0 TO 9999*

This is the total number of NORESP (no response) errors that have been detected.

TOTAL: *0 TO 99999*

This is the total number of errors that have been detected. This total equals the total number of MEBIT errors plus the total number of NORESP errors.

Halt Electrical Test

USE: *STOPS TRANSMISSION OF ELECTRICAL STIMULI AND DATA*

DESCRIPTION:

Use this command to halt the transmission of electrical stimuli and data being sent out on the specified bus by either of the two commands XMIT ELECTRICAL TEST FOREVER and RUN ELECTRICAL MEASUREMENT FOREVER, or by any of the three COMMON MODE options specified in the "Stimulus" field of the Electrical Stimulus Page (CMNMOD DC, CMNMOD FIXED, and CMNMOD SWEPT 1Hz–2MHz).

SYNTAX:

H<ALT> E<LEC TEST>
(bus no. ---) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

Halt Noise Test

USE: *HALTS (STOPS) NOISE TEST EXECUTION*

DESCRIPTION:

Use this command to halt execution of the noise test on the specified bus. When you enter the command, a status message will appear on your CRT screen informing you that the noise test has been halted.

A halted noise test can be resumed using the RESUME NOISE TEST command.

SYNTAX:

H<ALT> N<OISE TEST>
(bus no. —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

Resume Noise Test

USE: *RESUMES NOISE TEST EXECUTION*

DESCRIPTION:

Use this command to resume execution of the noise test on the specified bus. If the noise test was initiated using the RUN NOISE TEST command, then halted using the HALT NOISE TEST command, the noise-test-result counters will *not* be reset to zero.

When you enter this command, a status message will appear on your CRT screen informing you that the noise test has resumed execution.

Note that before using this command, you must set up the Electrical Stimulus Page with the command word that will be used in the noise test. The Electrical Stimulus Page is accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command.

SYNTAX:

RESU<ME> N<OISE TEST>
(bus no. —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

Run Electrical Measurement

USE: *TRANSMITS ELECTRICAL STIMULUS AND DATA SETUPS; CAPTURES BUS ACTIVITY*

DESCRIPTION:

Use this command to transmit the electrical stimulus parameters, the BC command word, and the data words you set up on the Electrical Stimulus Page, and to then take a "snapshot" of the bus activity resulting from the transmitted message. The captured data will be stored in an 80K-byte snapshot buffer (capture memory). This snapshot buffer gathers the waveform values of up to 40 consecutive words of 1553 bus traffic.

Also use this command to take a snapshot of the data on the bus when the Electrical Stimulus Page is disabled—but to do this, make sure you set up the "Bus Select" and "Bus Coupling" fields of the Electrical Stimulus Page correctly: set the "Bus Select" field to PRI (primary) or SEC (secondary), depending on whether you're using the primary or secondary bus, and set the "Bus Coupling" field to XFORMER (transformer) or DIRECT, depending on whether your RT is connected to the bus using a transformer coupling or a direct coupling. Do *not* set the "Bus Coupling" field to ISOLATED.

NOTE: To use the RUN ELECTRICAL MEASUREMENT command, you must either have a "live" RT hooked up to your System 300 or have an internal static RT or dynamic RT set up inside the system using the XFORMER mode (again, specify XFORMER in the "Bus Coupling" field of the Electrical Stimulus Page).

SYNTAX:

RU<N> E<LEC MEASUREMENT>
(bus no. —) <1> (to) <8>
FU<LL>
FO<REVER>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

QUANTITY SELECTION: *FULL OR FOREVER*

Select how many times the test is to run on the specified bus: either until the electrical snapshot buffer is full (FULL) or indefinitely (FOREVER). RUN ELECTRICAL MEASUREMENT FULL will cause the system to fill the snapshot buffer once and then stop gathering data. RUN ELECTRICAL MEASUREMENT FOREVER will let the snapshot buffer keep acquiring data until you enter a HALT ELECTRICAL TEST command. In the latter case, when the snapshot buffer fills up, the data wraps around to the beginning of the buffer and starts filling it up from the beginning again. When you specify FOREVER, the message captured for measurements is the last message transmitted when you enter the HALT ELECTRICAL TEST command. *NOTE: Do not use the FOREVER option if you have specified the RIPPLE MSG ZERO XING condition in the "Stimulus" field of the Electrical Stimulus Page (accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command).*

The default value for this option is FULL.

NOTE:

If you have specified any of the three common mode options in the "Stimulus" field of the Electrical Stimulus Page – CMNMOD DC, CMNMOD FIXED, or CMNMOD SWEPT 1Hz–2MHz – then after using this command you must use the HALT ELECTRICAL TEST command to halt the common mode stimulus.

Run Noise Test

USE: *EXECUTES NOISE TEST*

DESCRIPTION:

Use this command to begin executing the noise test on the specified bus. When you enter the command, the noise test result counters will reset to zero, and a status message will appear on your CRT screen informing you that the noise test is running.

Note that before using this command to execute the noise test, you must first set up a BC (Bus Controller) Page with the command word to be transmitted (and other information), set up Frame Format Page A with the number of the BC Page containing the command word, and set up the Electrical Stimulus Page with the NOISE GATE option in the "Stimulus" field, along with the duration and amplitude of the internally generated noise signal (and other information). Complete instructions for setting up and performing the electrical noise test appear in Section 4 of this manual, "Getting Started."

SYNTAX:

RU<N> N<OISE TEST>
(bus no. —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual–redundant bus to be used. The default bus number is 1.

The number of dual–redundant buses in a system depends on the number of Monitor Modules in the system: one dual–redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual–redundant buses. BC and RT simulation can occur on only one dual–redundant bus in such a configuration, since there is room for only one Simulator Module.

Save Electrical BC/RT Stimulus

USE: *SAVES ELECTRICAL STIMULUS SETUPS*

DESCRIPTION:

Use this command to save the stimulus setups you entered on the Electrical Stimulus Page. The setups are saved to the specified destination for the selected bus. Note that this information is also saved as part of the information saved when you enter the SAVE ELECTRICAL MEASUREMENTS command.

SYNTAX:

S<AVE> E<LEC> B<C/RT STIMULUS>
(bus no. —) <1> (to) <8>
<TO>
H<OST>
G<PIB>
A<PORT>
B<PORT>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

DESTINATION OPTION: *HOST, GPIB, APORT, BPORT*

Enter HOST to select the System 300 default host port (as specified in the "Save/Recv Default Host" field of the System I/O Setup Page, which you can access with the command DISPLAY SYSTEM IOSETUP); enter GPIB to select the GPIB port; enter APORT to select the RS-232 "A" port; and enter BPORT to select the RS-232 "B" port. (The GPIB, RS-232 "A," and RS-232 "B" ports are set up on the System I/O Setup Page -- the GPIB port in the "GPIB Parallel Port" section, and the RS-232 "A" and "B" ports in the "RS232 Serial Ports" section.)

NOTE: If you select HOST as the destination option and you specify APORT or BPORT in the "Save/Recv Default Host" field of the System I/O Setup Page, the electrical stimulus setups will be saved according to the RS-232 protocol specified in the "Save/Recv Protocol (RS232)" field of the System I/O Setup Page -- either NONE for no protocol or XMODEM for xmodem protocol.

Save Electrical Measurements

USE: *SAVES ELECTRICAL MEASUREMENTS, STIMULUS SETUPS, WAVEFORM INFORMATION, AND NOISE TEST RESULTS*

DESCRIPTION:

Use this command to save the electrical measurements that appear on the Electrical Measurements Page when you display the page following an electrical test performed on an RT. The command also saves the stimulus setups as set up on the Electrical Stimulus Page, the waveform information captured in the System 300's electrical snapshot buffer, and the results of the noise test, if performed—which is equivalent to the contents of the Electrical Noise Test Page. All saved information is saved to the specified destination for the selected bus. Note that after using this command you can reload the saved electrical measurements, stimulus setups, and waveform information but you *cannot* reload the saved noise test results.

SYNTAX:

```
S<AVE> E<LEC> M<EASUREMENTS> R<T>
      (bus no. —) <1> (to) <8>
           <TO>
              H<OST>
              G<PIB>
              A<PORT>
              B<PORT>
                 <RETURN>
```

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

DESTINATION OPTION: *HOST, GPIB, APORT, BPORT*

Enter HOST to select the System 300 default host port (as specified in the "Save/Recv Default Host" field of the System I/O Setup Page, which you can access with the command DISPLAY SYSTEM IOSETUP); enter GPIB to select the GPIB port; enter APORT to select the RS-232 "A" port; and enter BPORT to select the RS-232 "B" port. (The GPIB, RS-232 "A," and RS-232 "B" ports are set up on the System I/O Setup Page—the GPIB port in the "GPIB Parallel Port" section, and the RS-232 "A" and "B" ports in the "RS232 Serial Ports" section.)

NOTE: If you select HOST as the destination option and you specify APORT or BPORT in the "Save/Recv Default Host" field of the System I/O Setup Page, the saved information will be saved according to the RS-232 protocol specified in the "Save/Recv Protocol (RS232)" field of the System I/O Setup Page—either NONE for no protocol or XMODEM for xmodem protocol.

Save Electrical Noise Test

USE: *SAVES NOISE TEST RESULTS*

DESCRIPTION:

Use this command to save the results of the electrical noise test to the specified destination for the selected bus. These results are equivalent to the information displayed on the Electrical Noise Test Page, which is accessed using the DISPLAY ELECTRICAL NOISE TEST command.

The noise test results cannot be loaded back into the system once they have been saved.

Note that the noise test results are also saved when you use the SAVE ELECTRICAL MEASUREMENTS command.

SYNTAX:

S<AVE> E<LEC> N<OISE TEST>
(bus no. —) <1> (to) <8>
<TO>
H<OST>
G<PIB>
A<PORT>
B<PORT>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

DESTINATION OPTION: *HOST, GPIB, APORT, BPORT*

Enter HOST to select the System 300 default host port (as specified in the "Save/Recv Default Host" field of the System I/O Setup Page, which you can access with the command DISPLAY SYSTEM IOSETUP); enter GPIB to select the GPIB port; enter APORT to select the RS-232 "A" port; and enter BPORT to select the RS-232 "B" port. (The GPIB, RS-232 "A," and RS-232 "B" ports are set up on the System I/O Setup Page—the GPIB port in the "GPIB Parallel Port" section, and the RS-232 "A" and "B" ports in the "RS232 Serial Ports" section.)

NOTE: If you select HOST as the destination option and you specify APORT or BPORT in the "Save/Recv Default Host" field of the System I/O Setup Page, the noise test results will be saved according to the RS-232 protocol specified in the "Save/Recv Protocol (RS232)" field of the System I/O Setup Page—either NONE for no protocol or XMODEM for xmodem protocol.

Save Electrical Waveform

USE: *SAVES COPY OF ELECTRICAL SNAPSHOT BUFFER*

DESCRIPTION:

Use this command to save a copy of the 80K-byte electrical snapshot buffer (capture memory) containing the waveform values for the captured bus traffic resulting from the electrical test. The buffer copy is saved to the specified destination for the selected bus. Note that this information is also saved when you use the SAVE ELECTRICAL MEASUREMENTS command.

SYNTAX:

S<AVE> E<LEC> W<AVEFORM>
(bus no. ---) <1> (to) <8>
<TO>
H<OST>
G<PIB>
A<PORT>
B<PORT>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

DESTINATION OPTION: *HOST, GPIB, APORT, BPORT*

Enter HOST to select the System 300 default host port (as specified in the "Save/Recv Default Host" field of the System I/O Setup Page, which you can access with the command DISPLAY SYSTEM IOSETUP); enter GPIB to select the GPIB port; enter APORT to select the RS-232 "A" port; and enter BPORT to select the RS-232 "B" port. (The GPIB, RS-232 "A," and RS-232 "B" ports are set up on the System I/O Setup Page—the GPIB port in the "GPIB Parallel Port" section, and the RS-232 "A" and "B" ports in the "RS232 Serial Ports" section.)

NOTE: If you select HOST as the destination option and you specify APORT or BPORT in the "Save/Recv Default Host" field of the System I/O Setup Page, the digitized electrical data will be saved according to the RS-232 protocol specified in the "Save/Recv Protocol (RS232)" field of the System I/O Setup Page—either NONE for no protocol or XMODEM for xmodem protocol.

Set EMS Calibration

USE: *SETS UP/CLEARS INTERNAL CALIBRATION PARAMETERS DURING CALIBRATION PROCEDURES*

DESCRIPTION:

Use this command in conjunction with the calibration procedures in Section 3. The ON option sets up the internal calibration parameters that are used during the calibration procedures. The OFF option clears the internal calibration parameters. Use the command with the ON option before running the calibration, then use the command with the OFF option after running the calibration.

SYNTAX:

S<ET> E<MS CALIBRATION>
O<N>
OF<F>
(bus no: —) <1> (to) <8>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual-redundant bus to be used. The default bus number is 1.

The number of dual-redundant buses in a system depends on the number of Monitor Modules in the system: one dual-redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual-redundant buses. BC and RT simulation can occur on only one dual-redundant bus in such a configuration, since there is room for only one Simulator Module.

Xmit Electrical Test

USE: *STARTS TRANSMISSION OF ELECTRICAL SIGNAL AND BC WORDS*

DESCRIPTION:

Use this command to transmit the 1553 electrical signal stimuli, the BC command word, and the data words that you set up on the Electrical Stimulus Page. The signal and data will be transmitted on the specified bus the specified number of times.

NOTE: To stop transmission of the signal and data after specifying FOREVER as the number of transmission times (also represented by the number 00000), use the command HALT ELECTRICAL TEST. Also, if you have specified any of the three common mode options in the "Stimulus" field of the Electrical Stimulus Page—CMNMOD DC, CMNMOD FIXED, or CMNMOD SWEPT 1Hz–2MHz—then after using this command you must use the HALT ELECTRICAL TEST command to halt the common mode stimulus.

SYNTAX:

X<MIT> E<LEC TEST>
(bus no. —) <1> (to) <8>
(no. of times —) <xxxxx>
F<OREVER>
<RETURN>

BUS NUMBER: *1 TO 8*

Enter the number of the dual–redundant bus to be used. The default bus number is 1.

The number of dual–redundant buses in a system depends on the number of Monitor Modules in the system: one dual–redundant bus for each Monitor Module. In a System 300 with an EMS 310 Module Set installed, up to two Monitor Modules can be installed for a maximum of two dual–redundant buses. BC and RT simulation can occur on only one dual–redundant bus in such a configuration, since there is room for only one Simulator Module.

NUMBER OF TRANSMISSION TIMES: *00000 TO 65535, OR FOREVER*

Select the number of times you want the 1553 signal stimuli and BC words to be transmitted: either a number from 00000 to 65535, or FOREVER (indefinitely). The number 00000 represents FOREVER, or you can specify FOREVER explicitly. (To stop transmission after specifying FOREVER or 00000, use the HALT ELECTRICAL TEST command.) The default number of transmission times is 00001. *NOTE: Do not use the FOREVER option (or 00000) if you have specified the RIPPLE MSG ZERO XING condition in the "Stimulus" field of the Electrical Stimulus Page (accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command).*

Section 6

Error and Status Message Descriptions

Contents

EMS 310 Module Error Messages 6–3
EMS 310 Module Status Messages 6–15

Notes:

EMS 310 Module Error Messages

Table 6–1 lists, in alphabetical order, the error messages issued by the EMS 310 Module when a specific condition arises.

Table 6–1. EMS 310 Module Error Messages

Error Message	Definition and Suggested Corrective Action
BC: Ampl. HIGH reduced accuracy	The amplitude you have programmed in the "Waveform Amplitude" field of the Electrical Stimulus Page is too high to enable the system to measure the electrical characteristics of the responding waveform with guaranteed accuracy. The "Waveform Amplitude" field determines the amplitude of the BC signal being transmitted by the system when the electrical test is performed. As a result of this amplitude being too high, all of the measurements displayed on the Electrical Measurements Page will potentially exhibit reduced accuracy. **Suggested Corrective Action:** Display the Electrical Stimulus Page (using the DISPLAY ELECTRICAL BC TO RT STIMULUS command), enter the page, and reprogram the "Waveform Amplitude" field with a lower voltage. Then rerun the test.
Cannot Read RMS Voltage Value	The system was unable to read the RMS voltage value from the internal RMS voltmeter while performing the input impedance measurement. (The input impedance measurement is programmed with the ZIN option of the "Stimulus" field on the Electrical Stimulus Page, accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command.) **Suggested Corrective Action:** **1.** Rerun the input impedance calibration procedures (see Section 3 for these procedures). Make sure that when doing so the external input impedance calibration fixture is properly attached to the unit (see Section 2 for the proper hookup). *continued...*

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
	2. Set up the Electrical Stimulus Page with your test parameters again (use the DISPLAY ELECTRICAL BC TO RT STIMULUS command to access this page) and rerun the electrical test (using the RUN ELECTRICAL MEASUREMENT command). If the message displays again, repeat steps 1 and 2. If the message continues to display after several trials, this suggests a possible hardware malfunction, in which case you should call Loral Instrumentation Customer Service at 1–800–854–1036.
DC Offset Level noted on bus	This is an indication that some common mode differential offset was noted on the bus. This will not affect your measurements in any way.
Digitizer Still Busy	You are attempting to run the electrical measurements while the digitizer card of the EMS 310 Module is still dynamically capturing waveform data in its memory (probably from a previous execution of the RUN ELECTRICAL MEASUREMENT command, using the FOREVER option). You must first HALT (stop) the digitizer from collecting data before you can run the measurements. **Suggested Corrective Action:** Halt the digitizer memory by entering the HALT ELECTRICAL TEST command. Then run the electrical measurements using the RUN ELECTRICAL MEASUREMENT command.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
F.H.S. Amplitude not found	F.H.S. stands for "first–half sync," referring to the first half of the sync bit. This message indicates that the system was not able to find the first–half sync voltage level that you specified using the 1st–HSYNC option in the "Meas" (Measurement) field of the Electrical Stimulus Page, accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command. This suggests a DC offset problem—that is, that the DC level of the waveform was offset far enough from the zero level that the voltage level you specified was not in the actual waveform range. **Suggested Corrective Action:** **1.** If possible, check the amplitude of the actual waveform on the bus first, then decide on a new voltage level to use for the first–half sync amplitude. **2.** Now display the Electrical Stimulus Page, using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, cursor down to the "Meas" field, and reenter the 1st–HSYNC option, programming it with your new voltage level. **3.** Rerun the test, using the RUN ELECTRICAL MEASUREMENT command. If you are unable to check the amplitude of the actual waveform first, skip step 1 and perform steps 2 and 3, but in step 2 increase or decrease the voltage level by trial and error (it's either too low or too high), and repeat steps 2 and 3 until the message stops displaying or until you feel you've varied the voltage level a sufficient number of times. If the message continues to display, either the RT is at fault, or there is an internal malfunction of the System 300. Call Loral Instrumentation Customer Service at 1–800–854–1036.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
Frequency too high	The fixed common mode AC frequency you have programmed in the "Stimulus" field of the Electrical Stimulus Page (using the CMNMOD FIXED option) exceeds the maximum fixed common mode AC frequency that the system can be guaranteed to generate. This maximum is determined during power–up initialization, and varies slightly from power–up to power–up. It is also dependent on whether you use a transformer–coupled bus or a direct–coupled bus. **Suggested Corrective Action:** Display the Electrical Stimulus Page using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, enter the page, cursor down to the "Stimulus" field, and reprogram the field with a fixed common mode AC frequency that is reduced in value.
Impedance Measure Failed	The input impedance measurement test failed. This measurement is programmed as the ZIN condition in the "Stimulus" field of the Electrical Stimulus Page, accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command. Following are some possible causes of the failure: no waveform data was captured by the digitizer; waveform data was captured, but the waveform was very unstable and no reliable zero–crossing points were found; the RMS voltage was not measured during the test. Alternately, the external input impedance calibration fixture may not have been connected to the unit and/or you may not have performed the input impedance calibration procedures before running the test.

continued...

Error Message	Definition and Suggested Corrective Action
	Suggested Corrective Action: **1.** Check to see that the external input impedance calibration fixture is properly attached to the unit (see Section 2 for the proper hookup). Make sure the cables going from the calibration fixture to the EMS Module Set are properly connected at both ends, and make sure the cables going from the calibration fixture to the RT or other unit under test are properly connected at both ends as well. **2.** Rerun the input impedance calibration procedures (see Section 3 for these procedures). **3.** Set up the Electrical Stimulus Page with your test parameters again (use the DISPLAY ELECTRICAL BC TO RT STIMULUS command to access this page) and rerun the electrical test (using the RUN ELECTRICAL MEASUREMENT command). If the message displays again, repeat steps 1 through 3. If the message continues to display even though the calibration fixture is properly connected and the calibration procedures have been run prior to your running the electrical test, this suggests a possible hardware malfunction, in which case you should call Loral Instrumentation Customer Service at 1–800–854–1036.
L.H.P. Amplitude not found	L.H.P. stands for "last–half parity," referring to the last half of the parity bit. This message indicates that the system was not able to find the last–half parity voltage level that you specified using the Lst–HPAR option in the "Meas" (Measurement) field of the Electrical Stimulus Page, accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command. This suggests a DC offset problem—that is, that the DC level of the waveform was offset far enough from the zero level that the voltage level you specified was not in the actual waveform range. *continued...*

Error Message	Definition and Suggested Corrective Action
	Suggested Corrective Action: **1.** If possible, check the amplitude of the actual waveform on the bus first, then decide on a new voltage level to use for the last–half parity amplitude. **2.** Now display the Electrical Stimulus Page, using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, cursor down to the "Meas" field, and reenter the Lst–HPAR option, programming it with your new voltage level. **3.** Rerun the test, using the RUN ELECTRICAL MEASUREMENT command. If you are unable to check the amplitude of the actual waveform first, skip step 1 and perform steps 2 and 3, but in step 2 increase or decrease the voltage level by trial and error (it's either too low or too high), and repeat steps 2 and 3 until the message stops displaying or until you feel you've varied the voltage level a sufficient number of times. If the message continues to display, either the RT is at fault, or there is an internal malfunction of the System 300. Call Loral Instrumentation Customer Service at 1–800–854–1036.
Measurement Error – Rerun test	The EMS 310 Module was unable to take measurements on the data captured in digitizer memory. This generally indicates a severe distortion in the received signal. **Suggested Corrective Action:** Rerun the test by entering the RUN ELECTRICAL MEASUREMENT command, then attempt to display the electrical measurements again by entering the DISPLAY ELECTRICAL MEASUREMENTS command.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
No Digitizer Interrupt	Either the amplitude of the signals generated on the bus is too low to allow the signals to be recognized by the digitizer card of the EMS 310 Module, or the system has malfunctioned. In either case, the digitizer card did not issue an interrupt signal to the System 300 indicating that waveform data has been captured and is ready to have measurements taken upon it. **Suggested Corrective Action:** Rerun the test by entering the RUN ELECTRICAL MEASUREMENT command again. If the message shows up again, enter the RESET SYSTEM WARM START command, then rerun the test. If the message shows up again, enter the Electrical Stimulus Page (using the DISPLAY ELECTRICAL BC TO RT STIMULUS command) and increase the amplitude in either the "Waveform Amplitude" field or the "Stimulus" field, whichever seems to be primarily responsible for the low–amplitude signal ("Waveform Amplitude" controls the BC signal, "Stimulus" controls the RT signal). Then press RETURN to exit the page, and rerun the test. If the message shows up again, press the RESET button on the front panel, reenter your setups on the Electrical Stimulus Page, then rerun the test. If the message shows up again, turn off the system using the POWER button on the front panel, turn the system on again, reenter your setups on the Electrical Stimulus Page, and rerun the test. If the message still shows up, call Loral Instrumentation Customer Service at 1–800–854–1036.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
Noise Gate Setup Required	You attempted to run the electrical noise test without first selecting a noise gate option (either NOISE GATE or EXTERNAL NOISE GATE) in the "Stimulus" field of the Electrical Stimulus Page. (The noise gate option selects which source—either internal or external—will control the generation of the noise signal, and, if the noise gate is internal, what the duration and amplitude of the noise signal will be.) This message will display only after either the RUN NOISE TEST command or the RESUME NOISE TEST command is entered. **Suggested Corrective Action:** Display the Electrical Stimulus Page (using the DISPLAY ELECTRICAL BC TO RT STIMULUS command), enter the page and cursor down to the "Stimulus" field, select either NOISE GATE for an internal noise gate (and specify the duration and amplitude of the noise signal) or EXTERNAL NOISE GATE for an external noise gate, exit the page by pressing RETURN, and rerun the noise test by either entering the RUN NOISE TEST command again or entering the RESUME NOISE TEST command.
No RT Response	The RT (remote terminal) under test is not responding to the command word being transmitted by the EMS 310 Module. This may also be an indication that the amplitude programmed in the "Waveform Amplitude" field of the Electrical Stimulus Page differs from that of the RT under test by an order of magnitude. **Suggested Corrective Action:** Display the Electrical Stimulus Page (using the DISPLAY ELECTRICAL BC TO RT STIMULUS command), enter the page, modify the "Waveform Amplitude" field, exit the page by pressing RETURN, and rerun the test.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
No Valid Waveform Data	You are attempting to display electrical measurements when there is no valid waveform data in the digitizer memory to be measured. **Suggested Corrective Action:** Rerun the test by entering the RUN ELECTRICAL MEASUREMENT command, then attempt to display the measurements again by entering the DISPLAY ELECTRICAL MEASUREMENTS command.
RT: Ampl. HIGH reduced accuracy	The amplitude of the signal being transmitted by the RT (remote terminal) under test is too high to enable the system to measure the electrical characteristics of the waveform with guaranteed accuracy. Therefore, all of the measurements displayed on the Electrical Measurements Page will potentially exhibit reduced accuracy.
RT: Ampl. LOW reduced accuracy	The amplitude of the signal being transmitted by the RT (remote terminal) under test is too low to enable the system to measure the electrical characteristics of the waveform with guaranteed accuracy. Therefore, all of the measurements displayed on the Electrical Measurements Page will potentially exhibit reduced accuracy.
Run Electrical Measurement First	You have attempted to display the electrical measurements after changing certain setups on the Electrical Stimulus Page and without running the electrical measurements first, using the RUN ELECTRICAL MEASUREMENT command. **Suggested Corrective Action:** Enter the RUN ELECTRICAL MEASUREMENT command, *then* enter the DISPLAY ELECTRICAL MEASUREMENTS command.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
Stimulus Page not Enabled	The "BC to RT Stimulus Enable" field of the Electrical Stimulus Page is set to NO. This field must be set to YES in order for the Electrical Stimulus Page to be enabled. **Suggested Corrective Action:** Display the Electrical Stimulus Page using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, enter the page, and set the "BC to RT Stimulus Enable" field to YES. Press RETURN to exit the page.
Sync Bit not found – Rerun test	You attempted to display the electrical measurements, but the system was unable to find the sync pattern in the data that was captured in digitizer memory. As a result, electrical measurements are unable to be taken. **Suggested Corrective Action:** Rerun the test by entering the RUN ELECTRICAL MEASUREMENT command again, then attempt to display the electrical measurements again by entering the DISPLAY ELECTRICAL MEASUREMENTS command.
Voltage too high	The common mode voltage you have programmed in the "Stimulus" field of the Electrical Stimulus Page (using either the CMNMOD DC, the CMNMOD FIXED, or the CMNMOD SWEPT option) exceeds, in absolute value, the maximum common mode voltage that the system can be guaranteed to generate. This maximum is determined during power–up initialization, and varies slightly from power–up to power–up. It is also dependent on whether you use a transformer–coupled bus or a direct–coupled bus. **Suggested Corrective Action:** Display the Electrical Stimulus Page using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, enter the page, cursor down to the "Stimulus" field, and reprogram the field with a common mode voltage that is reduced in absolute value.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
Word not found in Digitizer	The word you selected for measurement in the "Word" subfield of the "Window" field on the Electrical Measurements Page falls outside the range of acceptable words for this test. **Suggested Corrective Action:** Look at the "Window Words 0 – XX" status message that appears above the DISPLAY ELECTRICAL MEASUREMENTS command (see the description of this status message later in this section). XX is the highest number you can enter in the "Word" subfield of the Electrical Measurements Page for this test. Getting the "Word not found in Digitizer" error message indicates that you have entered a word number higher than XX. Enter the Electrical Measurements Page (redisplay it using the DISPLAY ELECTRICAL MEASUREMENTS command if necessary) and reprogram the "Word" subfield with a number between 0 and XX (inclusive). Press RETURN to exit the page, then type DISPLAY ELECTRICAL MEASUREMENTS again to calculate and display the new measurements.
ZC: Shift HIGH reduced accuracy	ZC stands for "zero crossing." The value you have entered for the zero–crossing deviation in the "Stimulus" field of the Electrical Stimulus Page (using the ZERO option) exceeds 250 nanoseconds in absolute value. As a result, all of the measurements displayed on the Electrical Measurements Page will potentially exhibit reduced accuracy. Note that the value you can enter for the zero–crossing deviation in the "Stimulus" field of the Electrical Stimulus Page is a three–digit number going from 000 to 999 in either direction, positively or negatively, and is measured in nanoseconds. However, 250 nanoseconds (in absolute value) is the maximum zero–crossing deviation that can be entered that will enable the system to measure the electrical characteristics of the responding waveform with guaranteed accuracy.

continued...

Table 6–1. EMS 310 Module Error Messages (continued)

Error Message	Definition and Suggested Corrective Action
	Suggested Corrective Action: If you wish improved accuracy, display the Electrical Stimulus Page using the DISPLAY ELECTRICAL BC TO RT STIMULUS command, enter the page, cursor down to the "Stimulus" field, and program the field with a zero–crossing deviation that falls within the ±250–nanosecond range.
ZIN Calibration Failed	The input impedance calibration has failed.
	Suggested Corrective Action: Check to see that the steps of the input impedance calibration procedure have been performed correctly (see Section 3 for the proper procedure). Repeat the procedure. If the message continues to display after several tries, call Loral Instrumentation Customer Service at 1–800–854–1036.

EMS 310 Module Status Messages

Table 6–2 lists, in alphabetical order, the status messages issued by the EMS 310 Module when a specific condition arises.

Table 6–2. EMS 310 Module Status Messages

Status Message	Definition
Calculated ZC level: ±XXX mV	This appears after you enter the DISPLAY ELECTRICAL MEASUREMENTS command, but only if you have specified the 1st–HSYNC (first–half sync) condition or the Lst–HPAR (last–half parity) condition in the "Measurement" field of the Electrical Stimulus Page. XXX will be displayed as either a positive value or a negative value, and ranges from 000 to 500. It is the real, calculated zero crossing voltage level, in millivolts, of either the first–half sync or the last–half parity, depending on what you specified. (The ideal zero crossing level is 0 millivolts.)
Calculating Measurements	This appears after you enter the DISPLAY ELECTRICAL MEASUREMENTS command. The system is calculating the electrical measurements, using the waveform data that was captured in digitizer memory and using the criteria you specified on the Electrical Measurements Page, including pass/fail limits and word, bit, and edge selection. NOTE: The system takes approximately 15 seconds to calculate the measurements, hence the pause associated with this status message.
F.S. Repeated X Times	This appears each time a frequency stability measurement is taken by the System 300, and cycles through the values of X from 1 to 10. To obtain the frequency stability measurement, the System 300 takes the measurement 10 times and then averages the resulting values. The averaged value is used as the final measurement.

continued...

Table 6–2. EMS 310 Module Status Messages (continued)

Status Message	Definition
Noise Test Halted	This appears after you enter the HALT NOISE TEST command. It indicates that the electrical noise test is currently in the HALT state—that is, execution of the test has been stopped. Execution can be resumed using the RESUME NOISE TEST command.
Noise Test Resumed	This appears after you enter the RESUME NOISE TEST command. It indicates that the electrical noise test has resumed executing after it was halted with the HALT NOISE TEST command.
Running Measurements	This appears after you enter either the RUN ELECTRICAL MEASUREMENT command or the XMIT ELECTRICAL TEST command. The system has generated the stimulated signal and is now gathering waveform data in digitizer memory and performing certain measurements on both that data and the stimulated signal to make sure both are within the required limits of the test. NOTE: The system takes approximately 15 seconds to run the measurements, hence the pause associated with this status message.
Running Noise Test	This appears after you enter the RUN NOISE TEST command. It indicates that the electrical noise test is currently running (executing).

continued...

Table 6–2. EMS 310 Module Status Messages (continued)

Status Message	Definition
Window Words 0 – XX	This appears after you enter the DISPLAY ELECTRICAL MEASUREMENTS command. It indicates the range of words that have been captured in digitizer memory. The first number is fixed at zero, and is the word number of the first captured word. XX can range from 0 to 39, and represents the word number of the last captured word. As an example, if the message is displayed as "Window Words 0 – 6," seven words have been captured in digitizer memory, and the word numbers for these words range from 0 to 6. If the message is displayed as "Window Words 0 – 39," 40 words have been captured in digitizer memory (the maximum number of words the digitizer can capture), and the word numbers for these words range from 0 to 39. The range in this status message determines the word numbers available for you to enter in the "Word" subfield of the "Window" field on the Electrical Measurements Page. Note, however, that the maximum word number you can enter in that subfield is 33, regardless of the number of words that have been captured (i.e., regardless of how high XX goes).
Window Words Empty	This appears in place of the "Window Words 0 – XX" status message, after you enter the DISPLAY ELECTRICAL MEASUREMENTS command, when no words have been captured in digitizer memory.

continued...

Table 6–2. EMS 310 Module Status Messages (continued)

Status Message	Definition
ZIN Calibration: XXXX KHz	This appears after you enter the RUN ELECTRICAL MEASUREMENT command during the input impedance calibration procedures, provided you have first set the EMS Calibration feature to ON using the SET EMS CALIBRATION command. (See the input impedance calibration procedures in Section 3. ZIN stands for "input impedance"—Z for "impedance," IN for "input.") The message indicates that the frequency XXXX is being calibrated, and it will step through the ten values of XXXX dynamically, while the calibrations are being performed. The ten values are 0075, 0100, 0150, 0200, 0250, 0300, 0333, 0400, 0500, and 1000, all in kilohertz (KHz). These are the same values that can be selected using the ZIN option of the "Stimulus" field on the Electrical Stimulus Page, accessed using the DISPLAY ELECTRICAL BC TO RT STIMULUS command.
ZIN Calibration Done	This indicates that the input impedance calibration procedure has been successfully completed. Remember to set the internal System 300 calibration feature to OFF (using the SET EMS CALIBRATION OFF command) and to set the external input impedance calibration fixture switch to the "NORMAL" setting before running the input impedance measurements.

Section 7

Electrical Measurement and Stimulus (EMS 310) Module Command Set Card

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